IN with COM p. 85

73® Amateur Radio

January 1987
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A WGE Publication

Introducing The New DX Dynasty Award!

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- 15 Special Endorsements
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220MHz IC-38A
440MHz IC-48A
Now Available!

ICOM IC-28A/H
THE ONE FOR THE ROAD

- **Compact Size**
- **Simple to Operate**
- **Large LCD Readout**
- **25 Watt IC-28A**
- **45 Watt IC-28H**
- **Packet Compatible**
- **21 Memory Channels**

The IC-28H has all the features you need for carefree 2-meter mobile operation. The only thing it doesn't have is a big price.

45 Watts. The IC-28H provides a full 45 watts of powerful output. The **IC-28A** 25-watt version is also available. Both units have a selectable low power.

Large LCD readout. A wide-view LCD readout can be easily read even in bright sunlight. An automatic dimmer circuit reduces the brightness for evening operation.

Wideband Coverage. The IC-28H performs from 138–174MHz (specifications guaranteed from 144.00–148MHz) and includes weather channels. Ideal for MARS and CAP operation.

Compact Size. The IC-28H measures only 2 inches high by 5½ inches wide by 7¼ inches deep (IC-28A is 5¼ inches deep). Great for mobile insta lations where space is limited.

21 Memory Channels. Store 21 frequencies into memory, or lock out certain memory channels. All memorie are backed up with a lithium battery.

Scanning. Scan the entire band or the memory channels from the pr vided HM-12 mic.

Easy to Operate. With only 11 front panel controls, the IC-28H is simple to operate.

Available Options. IC-HM14 DTMF mic, PS-45 13.8V 8A power sup ply, UT-29 tone squelch unit, SP-10 external speaker, IC-HM16 speaker m and HS-15/HS-15SB flexible boom mic and PTT switchbox.

The IC-27H 45 watt and IC-27A 25 watt ultra compact 2-meter mobiles continue to be available.

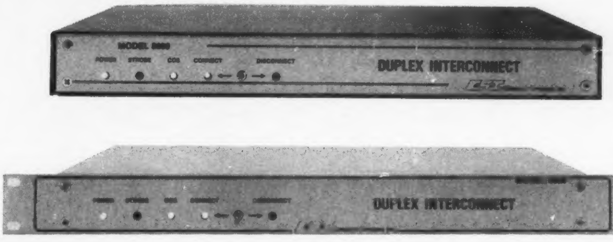
ICOM

First in Communications

ICOM America, Inc., 2380–116th Ave NE, Bellevue, WA 98004 **Customer Service Hotline (206) 454-761**
3150 Premier Drive, Suite 126, Irving, TX 7506
ICOM CANADA, A Division of ICOM America, Inc., 3071 – #5 Road, Unit 9, Richmond, B.C. V6X 2T4 Canad

All stated specifications are approximate and subject to change without notice or obligation. All radios significantly exceed FCC regulations limiting spurious emissions. 28H98

MODEL 8000 DUPLEX



- Desk top or rack mounted versions
- Pulse or fully regenerated tone dialing
- Full and half duplex operation
- Half duplex privacy mode
- Internally squelched audio
- Powerful toll call protection
- Secret toll override code
- ✱ up # down or multi-digit access
- Ringout
- End to end signalling (DTMF standard)
- Auto answer on 1st, 2nd, 4th or 8th incoming ring
- Mobile to mobile signalling
- Telephone initiated control mode
- Dip switch selectable hybrid compensation capacitance.
- Programmable timout and mobile activity timers with unique beeps
- Disconnect beep
- Separate repeat level control
- Lightning protection
- Connectors for options
- 10-16VDC powered

28 dip switches make all features user programmable and selectable.

OPTIONS

8001 ANI code validator (up to 1024 access codes)
8002 1000 call two tone signalling
8003 32 call CTCSS signalling
8004 FCC registered coupler
8005 Centralized computer billing system

NOW ANYONE CAN ENJOY FULL DUPLEX!

Merely connect a CSI Model 8000 to any duplex base (such as the Yaesu FT-2700RH) and presto . . . you have an instant full duplex mobile telephone system!

Or, the 8000 can be connected to any repeater for shared use. A landline caller can selectively call any mobile on the system with (end to end) regenerated DTMF (standard), CTCSS (optional) or two tone sequential (optional). Mobiles can even selectively call **each other!**

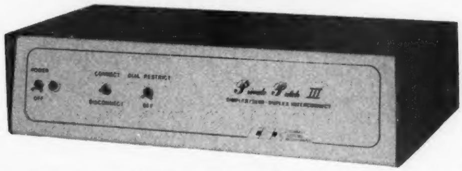
Knowing the correct code, a caller can **take control** of the 8000 from any touch phone and **voice communicate** with mobiles that are not equipped with touch dialers.

No other duplex patch offers so much for so little.

FIRST CLASS FEATURES and PERFORMANCE . . . COACH FARE!

MAKE YOUR MOBILE TELEPHONE SYSTEM FLY WITH A PATCH FROM CSI

PRIVATE PATCH III



A high performance VOX based patch for simplex systems and for operation through remotely located repeaters.

Thousands of Private Patch III's are in both amateur and commercial use worldwide. Private Patch III enjoys a reputation that is second to none.

CW ID and other powerful features make Private Patch III the best deal going in Vox Simplex phone patches!

MODEL CS-9500

Control Station Interconnect

For exemplary simplex performance, the CS-9500 control station interconnect incorporates a full ½ second of landline to mobile electronic voice delay. Voice delay assures compatibility with the slowest CTCSS or trunked repeater systems.

Attractively styled to complement any decor.

STANDARD FEATURES (Both models)

- Three simple connections to base radio
- Simplex operation (VOX, of course)
- Digital "fast VOX"
- Toll restrict
- Secret toll disable code
- Selectable tone or pulse dialing
- Automatic busy signal disconnect
- Control interrupt timer (maintains positive control in simplex mode)
- Three digit access code (eg. ✱ 73)
- Ringout (reverse patch)
- Ringout inhibit if channel is in use
- Lightning protectors
- Spare relay position
- 110VAC supply
- And much more

OPTIONS: 12 VDC or 230 VAC power
FCC registered coupler

CONNECT SYSTEMS INC.
23731 Madison St.
Torrance CA 90505
Phone: (213) 373-6803

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HENRY RADIO
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INTERNATIONAL RADIO SYSTEMS
Miami, FL
JUNS ELECTRONICS
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Burnaby, B.C.
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Vancouver, BC

✓12

Or This Inexpensive

It Really Shouldn't Be This Easy

Remember just a few years ago, how it took a roomful of equipment just to work RTTY. And if you wanted more than one mode it took a dedicated computer system costing thousands of dollars. The new AEA Pakratts are proving it doesn't take lots of equipment or money to enjoy working all bands in five different modes.

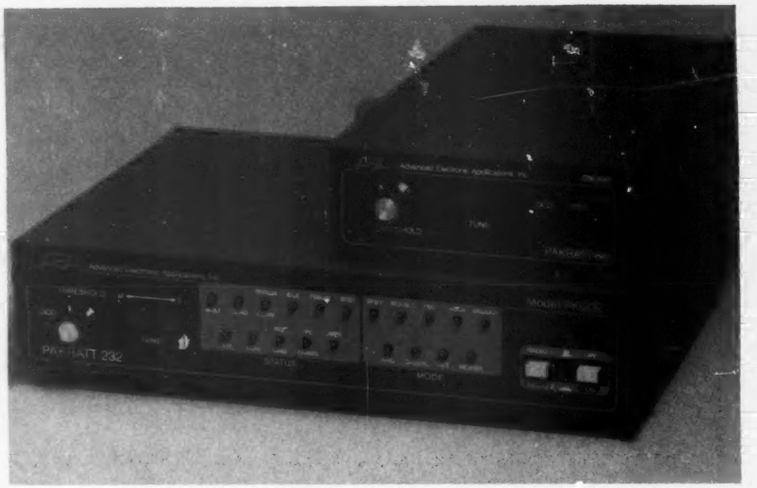
First, A Good Idea

The idea behind the Pakratt is very simple. One controller that does Morse, Baudot, ASCII, AMTOR, and Packet, and works both HF and VHF bands. Of course the decoding, protocol, and signal processing software must be included in the unit, and connection to the computer and transceiver have to be easy. The unit also has to be small and require only 12 volts, so it will work both in the shack and on the road.

Second, Computer Compatible

It doesn't matter what kind of computer you have, we have a Pakratt for you. The PK-64 works with the popular Commodore 64 or 128, and the PK-232 works with any other computer or terminal that has an RS-232 serial port. The PK-64 doesn't require any additional programs. Simply connect to the computer and transceiver and you're on the air. The PK-232 needs a terminal or modem program for your computer. The one you're using with your telephone modem will work just fine.

PAKRATT™ Model PK-64



PAKRATT™ Model PK-232

Third, Performance and Features

The real measure of any data controller is what kind of on-air performance it gives. While the PK-64 and PK-232 use different types of modems, both give excellent performance on VHF. The optional HF modem of the PK-64 uses independent four-pole Chebyshev filters for both Mark and Space tones, and A.M. detection. The HF option can be factory or field installed.

The PK-232 uses an eight-pole bandpass filter followed by a limiter discriminator with automatic threshold correction. The internal modem automatically selects the filter parameters, CW Fc = 800 Hz, BW = 200 Hz; HF Fc = 2210 Hz, BW = 450 Hz; VHF Fc = 1700 Hz, BW = 2600 Hz.

The PK-64 uses on screen indicators to show status, mode, and DCD (Data Carrier Detect) while the PK-232 uses front panel indicators. Both units use discriminator style tuning for HF operation. And that's just the tip of the iceberg. Features like multiple connects on packet, hardware HDLC, CW speed tracking, and other standard AEA software features are included in both the PK-64 and PK-232.

Fourth, AEA Quality and Price

Not many manufacturers like to discuss quality and price at the same time. AEA thinks you want high quality and low price in any product you buy, so that's what you get with the Pakratts. Ask any friend who owns AEA gear about our quality. The people who buy our products are our best salespeople. As for price, the PK-64 costs $219.95, or $319.95 with the HF option. The PK-64A, an enhanced software unit with a longer flexible computer cable, costs $269.95 or $369.95 with the HF option. The PK-232 costs $319.95 with the HF modem included. All prices are Amateur Net and available from your favorite amateur radio dealer. For more information contact your local dealer or AEA.

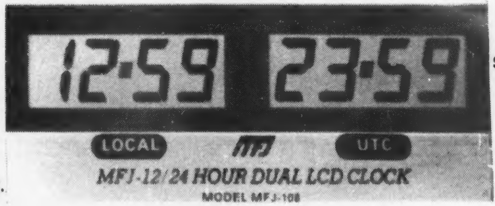
Prices and specifications subject to change without notice or obligation.

✓65

AEA
Advanced Electronic Applications, Inc.
P.O. Box C-2160, Lynnwood, WA 98036-0918
206-775-7373 Telex 6972496 AEA INTL UW

BEST OF MFJ

MFJ 24 HOUR LCD CLOCKS



MFJ-108 $19.95

MFJ-107 $9.95

23:59
MFJ
MFJ-24 HOUR LCD CLOCK
MODEL MFJ-107

These MFJ 24 hour clocks make your DXing, contesting, logging and SKEDing easier, more precise.

Read both UTC and local time at a glance with the MFJ-108, $19.95, dual clock that displays 24 and 12 hour time simultaneously. Or choose the **MFJ-107, $9.95** single clock for 24 hour UTC time.

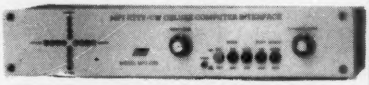
Both are mounted in a brushed aluminum frame, feature **huge easy-to-see 5/8 inch LCD numerals** and a sloped face that makes reading across-the-shack easy and pleasant.

You can read hour, minute, second, month and day and operate them in an alternating time-date display mode. You can also **synchronize them to WWV** for split-second timing. Both are **quartz controlled** for excellent accuracy.

They are **battery operated** so you don't have to reset them after a power failure, and battery operation makes them suitable for mobile and portable use. Long life battery included.

MFJ-108 is 4½x1x2 in. MFJ-107 is 2¼x1x2 in.

RTTY/ASCII/AMTOR/CW COMPUTER INTERFACE MFJ-1229 $179.95



Everything you need is included for sending and receiving RTTY/ASCII/CW on a Commodore 64 or VIC-20 and your ham rig. You get MFJ's most advanced computer interface, software on tape and all cables. Just plug in and operate.

The MFJ-1229 is a general purpose computer interface that will never be obsolete. An internal DIP switch, TTL and RS-232 ports lets you adapt the MFJ-1229 to nearly any home computer and even operate AMTOR with appropriate software.

A crosshair "scope" LED tuning array makes accurate tuning fast, easy and precise.

You can transmit both narrow (170 Hz) and wide (850 Hz) shift while the variable shift tuning lets you copy any shift (100-1000 Hz) and any speed (5-100 wpm, 0-300 baud ASCII).

Automatic threshold correction and sharp multi-pole active filters give good copy under severe QRM, weak signal and selective fading.

There's an FM (limiting) mode for easy trouble-free tuning that's best for general use and an AM (non-limiting) mode that gives superior performance under weak signals and heavy QRM.

A handy Normal/Reverse switch eliminates retuning while checking for inverted RTTY.

An extra sharp 800 Hz CW filter really separates the signals for excellent copy.

12½ x 12½ x 6 inches. Uses floating 18 VDC or 110 VAC with MFJ-1312, $9.95.

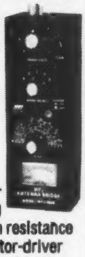
MFJ PORTABLE ANTENNA

MFJ's Portable Antenna lets you operate 40, 30, 20, 18, 15, 12, 10 meters from apartments, motels, camp sites, vacation spots, any electrically clear location where space for full size antenna is a problem.

A telescoping whip (extends 54 in.) is mounted on self-standing 5½ x 6¾ x 2¼ inch Phenolic case. Built-in antenna tuner, field strenght meter. 50 feet coax. Complete multi-band portable antenna system that you can use nearly anywhere. 300 watts PEP.

MFJ-1621
$79.95

MFJ ANTENNA BRIDGE MFJ-204B $79.95



Now you can quickly optimize your antenna for peak performance with this portable, totally self-contained antenna bridge that you can take to your antenna site—no other equipment is needed.

You can determine if your antenna is too long or too short, measure its resonant frequency and antenna resistance to 500 ohms. It's the easiest and most convenient way to determine antenna performance available today to anyone. There's nothing else like it and only MFJ has it. Built-in resistance bridge, null meter and tunable oscillator-driver (1.8-30 MHz). Uses 9 V battery. 4 x 2 x 2 inches.

REMOTE ACTIVE ANTENNA

The authoritative "World Radio TV Handbook" rates the MFJ-1024 as "a first-rate easy-to-operate active antenna ... Quiet. with excellent dynamic range and good gain ... Very low noise factor ... Broad frequency coverage ... the MFJ-1024 is an excellent choice in an active antenna"

54 inch remote active antenna mounts outdoor away from electrical noise for maximum signal and minimum noise pickup. Often outperforms long-wire hundreds of feet long. Mount anywhere-atop houses, buildings, balconies, apartments, ships.

Use with any radio to receive strong clear signals from all over the world. 50 KHz to 30 MHz. High dynamic range eliminates intermodulation. Inside control unit has 20 dB attenuator, gain control. Switch 2 receivers and auxiliary or active antenna. "On" LED. 6 x 2 x 5 in. 50 ft. coax. 12 VDC or 110 VAC with MFJ-1312, $9.95.

MFJ-1024
$129.95

200 WATT VERSA TUNER

MFJ-901B **$59.95**

MFJ's smallest 200 watt Versa Tuner matches coax, random wires and balanced lines from 1.8 thru 30 MHz. Works with all solid state and tube rigs. Very popular for use between transceiver and final amplifier. Efficient air-wound inductor gives more watts out. 4:1 balun, 5x2x6 in.

ROLLER INDUCTOR TUNER

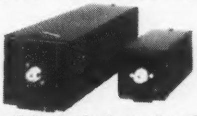
MFJ-989B **$329.95**

Meet the "Versa Tuner V", the compact roller inductor tuner that lets you run up to 3 KW PEP and match everything from 1.8 to 30 MHz.

Designed to match the new smaller rigs, the MFJ-989B is the best roller inductor tuner produced by MFJ. Our roller inductor tuner features a 3-digit turn counter plus a spinner knob for precise inductance control for maximum SWR reduction. Just take a look at all these other great features! **Built-in 300 watt, 50 ohm dummy load, built-in 4:1 balun and a built-in lighted cross-needle meter** that reads SWR and forward and reflected power all in one glance. Accuracy ± 10% full scale. Meter light requires 12 VDC. 6 position antenna switch. 10¾ × 4½ × 15 inches.

MFJ "DRY" DUMMY LOADS

MFJ-262
$64.95



MFJ-260
$26.95

MFJ's "Dry" dummy loads are air cooled—no messy oil. Just right for tests and fast tune up. Non-inductive 50 ohm resistor in aluminum housing with SO-239. Full load to 30 seconds, de-rating curve to 5 minutes. **MFJ-260 (300 watt),** SWR 1.1:1 to 30 MHz, 1.5:1, 30-160 MHz, 2½x2½x7 in. **MFJ-262 (1 KW),** SWR 1.5:1 to 30 MHz, 3x3x13 inches.

MFJ ELECTRONIC KEYER

MFJ-407
$69.95

MFJ-407 Deluxe Electronic Keyer sends iambic, automatic, semi-auto or manual. Use squeeze, single lever or straight key. Plus/minus keying. 8 to 50 WPM. Speed, weight, tone, volume controls. On/Off, Tune, Semi-auto switches. Speaker. RF proof. 7 x 2 x 6 inches. Uses 9 V battery, 6-9 VDC or 110 VAC with AC adapter, MFJ-1305, $9.95.

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BALONEY

The newest excuse I've heard for why kids are avoiding amateur radio is that, gee, the kids today have so many things to do they are passing ham radio by as a hobby. I never heard such utter crapola in my life.

This song and dance is coming from old men who should know better. I guess they're suffering from advanced memory loss or something—well, I'm not. I remember quite well when I got involved with amateur radio and I had no shortage of things to occupy my time.

I first got started building radio equipment when I was 14 and I kept at it hot and heavy for almost twenty years. Not that I've slacked off my hamming all that much in the last thirty years, it's just that I haven't been building as much.

Amateur radio had a lot of competition for me—and I'll bet I get a couple hundred letters from other old-timers who suddenly recall that, heck, there sure were a lot of things to keep kids busy, even fifty years ago.

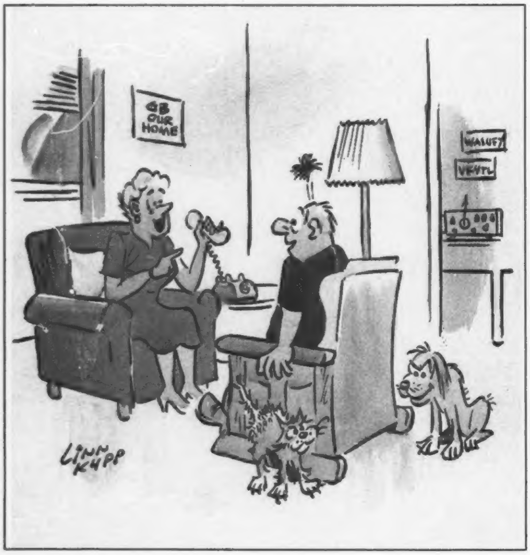
For instance, when I went to high school I joined the school radio club—W2ANU. But I also was quite active with the camera club—the book club—the choral club, where we rehearsed an hour every day and gave frequent professional performances—the Savoyards, where we rehearsed for months and then put on *The Mikado* (I played Koko) before the school assembly of about 10,000—plus I was a member of the Brooklyn Philharmonic Choir, with more rehearsals and concerts. And often in the evening I went roller skating all over Brooklyn with friends—went all over Brooklyn and Manhattan seeing two to four double-feature movies a week—dated girls on weekends—took weekly dancing lessons and went to dances—was a member of the Boy Scouts with a weekly troop and patrol meetings, hikes, and camping outings—bicycled now and then to New Jersey or Staten Island with friends—even did some homework. No, there was no shortage of things for a kid to do—and I wasn't all that much different from the other kids.

In college I joined the radio club (W2SZ), the Glee Club, the RPI Players, where I was the sound man, began building my classical record collection, built hi-fi equipment, was active in school politics, went to dances, dated, and so on. Oh, I bought my first car there and spent a good deal of time reworking my Model A Ford. I was also a supreme nuisance with my ham station and my invisible antenna wire strung across the freshman quadrangle, knocking out hundreds of cheap ac/dc dorm radios. They finally only allowed me to operate from 2 to 3 a.m., which was a great time for 160 meters.

I wasn't all that much in sports, but I got my varsity letter as a member of and manager of the fencing team—which meant many field trips to other schools for competitions. I also got darned good at swimming, bowled in the 180s, and spent many hours a week in the school darkroom developing and enlarging pictures. Tell me about kids today being too busy for hamming.

In the winter I went sledding in Prospect Park and ice skating in

Continued on page 10



"He says you just won a year's subscription to seventy-three magazines!"

This caption was contributed by Earle Post WA6ITG, who wins a one-year subscription for making us laugh. Thanks to the hundreds of readers who sent in their best knee-slappers.

QRM

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Contributions in the form of manuscripts with drawings and/or photographs are welcome and will be considered for possible publication. We can assume no responsibility for loss or damage to any material. Please enclose a stamped, self-addressed envelope with each submission. Payment for the use of any unsolicited material will be made upon acceptance. All contributions should be directed to the *73* editorial offices. "How to Write for *73*" guidelines are available upon request. US citizens must include their social security number with submitted manuscripts.

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KENWOOD

pacesetter in Amateur radio

NEW! Computer Interface!

"DX-cellence!"

TS-940S

The new TS-940S is a serious radio for the serious operator. Superb interference reduction circuits and high dynamic range receiver combine with superior transmitter design to give you no-nonsense, no compromise performance that gets your signals through! The exclusive multi-function LCD sub display graphically illustrates VBT, SSB slope, and other features.

- **100% duty cycle transmitter.** Super efficient cooling system using special air ducting works with the internal heavy-duty power supply to allow continuous transmission at full power output for periods exceeding one hour.
- **High stability, dual digital VFOs.** An optical encoder and the flywheel VFO knob give the TS-940S a positive tuning "feel."
- **Graphic display of operating features.** Exclusive multi-function LCD sub-display panel shows CW VBT, SSB slope tuning, as well as frequency, time, and AT- 940 antenna tuner status.
- **Low distortion transmitter.** Kenwood's unique transmitter design delivers top "quality Kenwood" sound.
- **Keyboard entry frequency selection.** Operating frequencies may be directly entered into the TS-940S without using the VFO knob.
- **QRM-fighting features.** Remove "rotten QRM" with the SSB slope tuning, CW VBT, notch filter, AF tune, and CW pitch controls.
- **Built-in FM, plus SSB, CW, AM, FSK.**
- **Semi or full break-in (QSK) CW.**
- **40 memory channels.** Mode and frequency may be stored in 4 groups of 10 channels each.
- **Programmable scanning.**
- **General coverage receiver.** Tunes from 150 kHz to 30 MHz.
- **1 yr. limited warranty.** Another Kenwood First!

Optional accessories:
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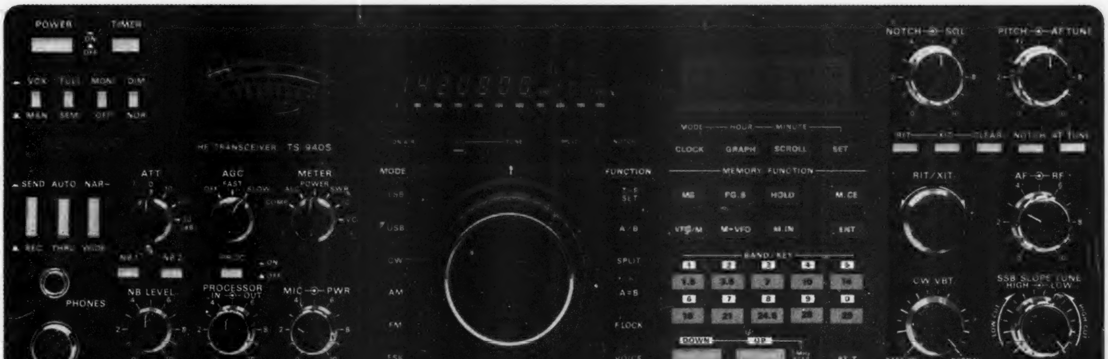
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EDITED BY PERRY DONHAM KW1O

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Peepers

HOW ABOUT giving your favorite ham rag a hand? We'd like to know where you're seeing *73* on the newsstands—and where you aren't. We're trying to make certain that everybody has a chance to get his own copy of the magazine each month (we've heard stories of postmen being mugged for their stash of subscription copies). Just jot down the name of at least one place you see it, and one place you don't, on a card and send it to *73* Magazine, WGE Center, Peterborough NH 03458, Attn: Peepers. We'll draw a few cards out of a hat and give those folks a one-year subscription or extension to *73*.

Watts Shakin'

WHILE MOST HAMS worry incessantly about the weather, hams in southern California turn their attention to the ground, especially when it starts to move. To bring hams with earthquake interests together, the **Seismic Discussion Net** meets every Friday evening at 10:30 local time on the W6FXN repeater (145.460 MHz) near Covina. The net attracts professional seismologists, amateur tremor-chasers, and the curious. Topics range from the dissemination of earthquake data to the description of home-brew seismic detectors. Whenever a major quake strikes, SDN members collect intensity and direction information; the W6FXN repeater automatically transmits telemetry tones when seismic activity in excess of 3.5 on the Richter scale is detected in the area.

Gerli Gets It

ARRL DEPUTY AD MANAGER Sandy Gerli AC1Y was the big winner at our Boxboro convention party for industry members. A very surprised Sandy received a Technics compact disc player, and at last report was seen racing into a CD store waving his charge cards.

9N1 Update

KRISHNA B. KHATRY 9N1MC, Chief Engineer for the Ministry of Communications in Nepal, wrote in to say that he is active from Kathmandu from 0900–1400 UTC on 10, 15, and 20 meters (and sometimes on 40 and 80 meters). Krishna's QSL address is the Ministry of Communications, Panchayat Plaza, Prithvi Path, Kathmandu, Nepal. Krishna's office issues licenses for Nepal, and he says that the only official calls operating there are 9N1MM, 9N1MC, and 9N1RN. 9N1HCK was licensed to operate for only a few days from July 30th to August 4th, 1986.

Krishna Khatry 9N1MC, QRV on 80–10.

South Shetland

THE SAME GROUP that brought you Flores Island CV0U in December of 1985 now has permission to activate South Shetland Island CX0XY in February of 1987. The exact date depends on transportation to the site by the Uruguayan Air Force, but you should have no trouble finding the pileups on the HF bands. QSLs go to the Uruguay DX Group, Box 20063, Montevideo, Uruguay, South America.

VITA Men

VOLUNTEERS IN TECHNICAL ASSISTANCE is looking for someone to work for three months this winter in Ethiopia. The job involves cooperating with CARE and the Relief and Rehabilitation Commission to integrate packet radio with an existing two-way radio system operated by the RRC, and training RRC staff members to use the new setup. This is a paid position and starts in January; if you're interested, quickly drop a note detailing your basic qualifications to Gary Garriott WA9FMQ, Manager for Information Technology, VITA, 1815 N. Lynn Street, Suite 20, Arlington VA 22209.

No, Yes, Maybe

WE'VE GIVEN UP trying to report on the fate of OSCAR 10. First it's dead, then it's feeling much better, then it's gone again. . . the latest report says that beacons are beaconing and that the sun angle is improving, giving hope that the Internal Housekeeping Unit (IHU) may be able to be reset. If the IHU responds, and the ground controllers are able to upload programs to AO-10, the satellite may again become usable. It's expected that the satellite will be running with 100% power as you read this, so keep an ear on the beacon at 145.8090 MHz.

Space Space

FROM *THE W1FN BULLETIN* (West Lebanon, New Hampshire) comes word that a limited amount of time will be available on the Hubble Space Telescope to amateur astronomers. Projects must have a clear scientific or educational value. Information and application forms can be had for $1 from HST Amateur Astronomers Working Group, c/o AAVSO, 25 Birch Street, Cambridge MA 02138. The deadline for completed applications is March 31, 1987.

Wayne, in a move to appease the League, bribes the ARRL's Sandy Gerli AC1Y with a free CD player.

Heard Again

IF YOU MISSED the last expedition to Heard Island, take heart. Jim Smith VK9NS, in a letter to *Long Island DX Bulletin* Editor Harvey McCoy W2IYX, said that the scientific expedition's meteorologist is a ham and plans to be on the air until about January 21st. This operation, combined with the recent very successful ventures, may put Heard permanently off the most-wanted DX list. Jim also mentioned that he is working on an expedition to Mellish Reef and Willis Island, possibly running in the first quarter of 1987.

Free Islands

A FREE MAP of the Pacific Islands is available from the Department of Planning and Economic Development, PO Box 2359, Honolulu HI 96804. Ask for the map titled "The New Pacific." (Thanks to the *BIARC Bulletin*.)

Dr. Destructo

$65,000 WORTH of illegal CB radios and amplifiers was destroyed by FCC Field Engineers recently in San Francisco. The equipment was taken from CB stores and private individuals who gave up the gear rather than face prosecution. Earlier, the FCC had seized equipment valued at $35,000 from Suburban Electronics of Fairfield, New Jersey, and two individuals, Larry Wallach and Gerard Purnhagen of L.W. Sales, received probation and fines totalling $12,000 for importing and marketing illegal CB radios. The commission has determined that 57% of the complaints of interference to electronic entertainment are the result of CB radios running over the legal output.

73's Art Director Dianne Ritson takes a coffee break during the shooting of last month's cover (photo by Dave Leifer N2ESS).

New! Improved!

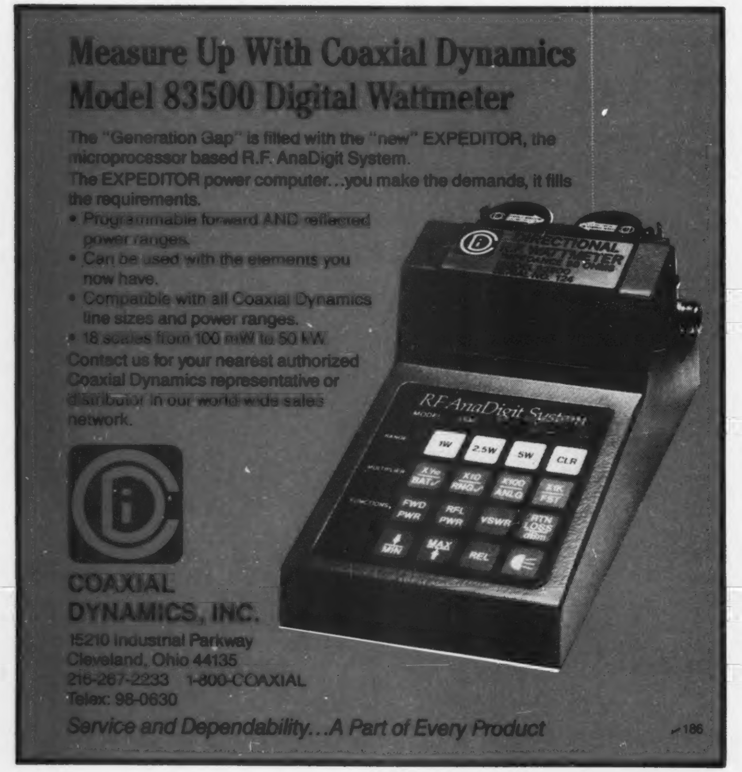
NEW THIS MONTH in *73* is our column covering amateur satellites, appropriately titled HAMSATS. Andy McAllister WA5ZIB will be keeping us up to date on all of the crazy things happening in the world of space radio. The improvement is to the ARRL's DXCC program; page 27 carries the announcement of our very own **DX Dynasty Award (DXDA)**. We've come up with nearly 400 countries to work, with an incredible variety of endorsements. The best part is that *everybody starts with zero countries on January 1st, 1987!* There'll be head-to-head competition between the DX neophytes and the Honor Rollers, at least for a few weeks.

JA Recip

CANADIAN AMATEURS are now eligible for reciprocal Japanese ham licenses according to an agreement that took effect on November 16, 1986. Japan also maintains reciprocity with the United States and West Germany. Canadian hams should contact the CRRL for specific information.

Listo!

MANY THANKS to the *W5YI Report*, *The Westlink Report*, and *Amateur Satellite Report* for help with this month's column. And from Wayne, Stu, Perry, Chris, Robin, Richard, Di, Steve, Jim, Nancy, Hope, and everyone else here at *73*: Happy New Year!



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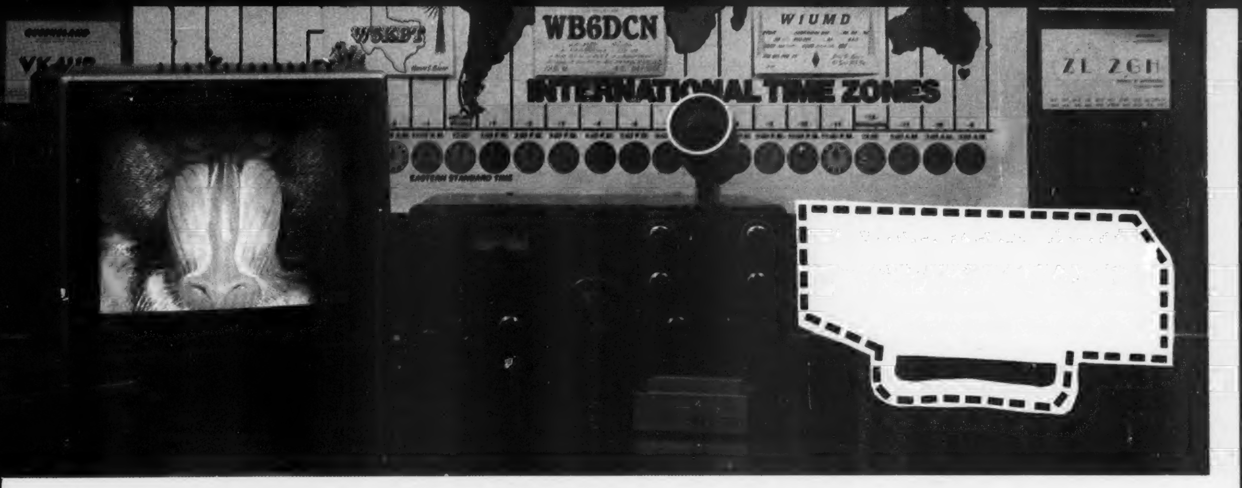

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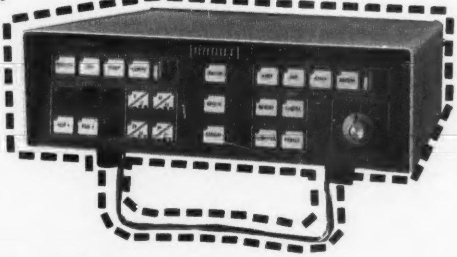

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NEVER SAY DIE

from page 4

both Central and Prospect Parks. When the snow kept us from roller skating on the streets of Brooklyn, we'd take our sleds, sneak out at corners when cars would stop, grab their back bumpers and take rides. Sometimes we'd set a destination—say Coney Island, about six miles away—and we'd see who could get there first. This was usually at night so the drivers wouldn't see us.

Let's see, we also put on *The Pirates of Penzance* (I was the Major General)—plus I occasionally would sing solos in assembly—which was nerve-wracking, even though I was taking voice lessons. Well, you get the idea—we kids had an enormous number of things to occupy our little minds, even back in those prehistoric times fifty years ago.

Amateur radio had to offer a lot since it was up against girls, dances, skating, sports, plus over 120 after-school activities in my high school. There was even a music appreciation club which I attended now and then, but that didn't keep me from building ham receivers and transmitters, test equipment, and audio gear.

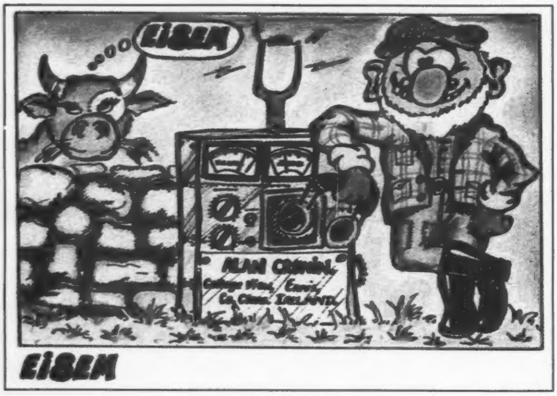
I even listened to the radio—Bob Hope, Fred Allen, Jack Benny, and other popular shows.

No, we can't blame computers, CB, TV, MTV, or even drugs for robbing amateur radio of youngsters. It's the lack of school radio clubs—almost all of which blew away in the mid-60s when the Incentive Licensing proposal killed 'em, just as it almost killed the whole hobby and almost every ham manufacturer. While this is obviously no reflection on the current ARRL management, that was certainly the worst miscalculation by the League in ham history. I said it at the time and boy, do I hate being right.

If we want to get amateur radio growing again—if we want to get kids interested—we shouldn't sit around telling ourselves lies to excuse the stupidity of a generation ago. We can thank Mort Kahn W2KR for that debacle—and he's dead now. Though he was only the Hudson Division Director, he actually ran the League from that position and made all of the major decisions for the directors.

I don't see much use in trying to interest kids in amateur radio if there aren't any school radio clubs to help them get their licenses once that interest is fired. Once we have school clubs we can get busy with ham articles in magazines—ham TV promotions—ham shows in malls, and so on. Once we get kids interested we'll find they have all the time in the world for something they want to do—just as we did. Also, it'll be a whale of a lot easier to get kids into hamming if we don't try to jam Morse code down their throats.

I first started seriously questioning the validity of the code test in 1956—thirtieth anniversary. I haven't made much headway yet, have I? In all that time I haven't heard one reason for the code which makes sense to me. Sure, I've heard every rationalization possible—heard 'em thousands of times. And I've shown these arguments to be hogwash. But I still hear 'em—mostly from old-timers these days—and not nearly as often, so perhaps we do have progress, as slow as it has been.



QSL OF THE MONTH

To enter your QSL, mail it in an envelope to *73*, WGE Center, 70 Rte. 202 N., Peterborough NH 03458, Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

I'm still getting an occasional letter from an old-timer who I suspect has been living in a cave for the last twenty years, completely out of touch with the world—or maybe just reading *Brand X*, which is about the same. These accuse me of wanting more hams so I'll have more subscribers to *73* and fill my money-grubbing pockets with wealth.

You won't find one single study of entrepreneurs which says they've any serious interest in making money. You aren't going to find anyone more entrepreneurial than me—I'm the same as the rest of 'em—money is just something I need to get things done. It's never been of any importance in itself. I've always worked very hard because I enjoy it and I've always been frugal—still am.

So let's stop making excuses for sitting on our duffs letting amateur radio gradually evaporate. Let's get busy starting school radio clubs—in grammar and high schools.

Talking about evaporating hams, in case you don't get *QST*, the Silent Keys column is no longer a couple inches long, the way it used to be. It took a full page in the November issue. And I mentioned that a recent *73* mailing bounced back over 12% of the FCC ham list as deceased. We've been losing hams far faster than the FCC has recognized. Plus the number of new hams dropped 8.5% last year, up from a 7.9% drop in 1984.

No, if amateur radio isn't growing as fast here as it is in Japan, where they've issued over two million ham licenses, it's because we're all sitting around hoping someone else will do something. There are no more excuses.

FOX HUNTING

Old-timers will fondly remember going on hidden-transmitter hunts. Fox hunts, as they're called in Europe, are a ball, but they tend to appeal more to younger hams—perhaps because it can take some physical

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work and thus is too much for fat old men who've almost destroyed their lungs smoking.

Fox hunts are one way we can make amateur radio more attractive for youngsters. I'll bet it was 25 years ago when the Philmont Club made movies of their fox hunts for other clubs to borrow. They were such fun to watch that I still remember 'em.

Kids can get extra fun from fox hunts by making their own directional antennas and detectors. I'll bet there are still some old-timers who have fox hunting gear around in a closet. How about blowing off the dust and writing an article on your design so we can lure kids into making a copy and getting involved with hunting.

Ham clubs could do a lot worse than set up a fox hunt once or twice a month. At first you have to make it easy, but as your hunters get wise to the usual tricks, you try to stay ahead of 'em.

I'm open for articles on fox hunting—how to make the fox hard to find—how to find a hard fox—the best equipment to use—and so on. All this practice suddenly comes in handy when someone jams a repeater or there's a stolen rig on channel.

Since hunters don't have to have a ticket, you might even get kids interested in joining your club hunts. Check with your local Scout group or 4-H Club and see if there are some kids who might be interested.

MORE FOOT SHOOTING

Too bad you weren't on the Asian electronic show tour with me this fall so you could have taken advantage of the windfall the U.S. has handed entrepreneurs. There will be a lot of instant millionaires this winter.

It has to do with protectionism, the fast fix politicians use to fight foreign competition, that without fail ends up making the situation worse. In this case the American chip industry got upset because the Japanese were making chips cheaper and better than they could, so they got Congress to legislate a minimum price on 'em. Memory chips which were selling for about $1.75 will now have to cost $8. Since computers are using these by the dozens, this would subtantially increase the manufacturing cost of American-made computers.

The answer is to move manufacturing to Asia and send over completed memory boards. This can be done without the minimum fixed price, so that's the end of making memory boards here. I'll bet there's going to be a rush of American computer firms to Asia to keep from being put out of business by this foolish new law. Congressmen aren't going to be happy until they chase every remaining shred of our electronic manufacturing offshore.

Well, that solves the problems we're having in getting kids interested in high-tech careers. If we get out of electronic manufacturing and service we won't need engineers and technicians.

Say, speaking of kids, did you know that over 50% of the graduate engineers in America today are foreigners visiting here for their education? Yep, less than 50% are Americans.

"50% of the graduate engineers in America are foreigners."

With microchips going into an ever increasing number of products, the loss of this industry to Japan is sure to have long-range problems for us both with civilian and military electronic equipment. Just look at the electronic equipment around us today—telephones, facsimile, copiers, VCRs, video cameras, microchips in cars, security, electronic locks. We're importing over $200 billion in electronic equipment now and that's supposed to keep increasing by about 30% a year for the next 15 years. Chips are the heart of electronics, as the Japanese have figured out.

If America isn't going to lose more and more high-tech industry to Asia, we're going to have to get serious about this. We need a couple million more electronic engineers and technicians than we have now. We need some serious help from the government to make our tax and government regulation systems support high tech instead of chasing it out of the country.

Amateur radio has been sliding downhill in America for twenty years and all I've seen so far in an effort to stop the slide is a comic book. I'm reading newsletters from over fifty ham clubs around the country and I can't remember one which has encouraged its club members to work together to do something about the loss of our hobby. In most it's business as usual . . . club meetings, gossip, a hamfest, an auction.

We CAN change this trend—this slide—by getting school radio clubs going. If your club has some success with this I'll pass the word on in *73* and that'll get other clubs going—we really can do it.

ARE WE REALLY WORTH OUR SALT?

Recently Bob Foosaner, Chief of the FCC's Personal Radio Bureau (just retired) valued the amateur VHF/UHF bands for commercial uses at as much as $300 billion. That comes to around $2 million for each and every active American amateur. I wonder how soon we'll see an attempted takeover by Carl Icahn? I'll bet he could buy the whole works for $10,000 per ham and make billions.

The fact is few hams have even a slight appreciation of the value of the bands we are using—or worse, not using. How long do you think the FCC is going to save these incredibly valuable bands for a bunch of selfish old men who won't even bother to get kids interested in their hobby?

A ham at the recent Minneapolis Hamfest said he saw the old-timers who helped the ARRL kill the no-code effort a few years ago as sitting in a lifeboat, stamping on the fingers of those trying to get in. Interesting simile.

Fred Maia, in his *W5YI Report* for October 15th, quoted Tony England W0ORE on the subject of Morse code. The FCC regulations call for an Extra-class license to operate from space, so every astronaut ham so far has had to get a waiver from the FCC to operate. Said Tony . . .

> It is not required that astronauts know the Morse code. It is not very important for an astronaut to know the Morse code.
>
> I think astronauts should be amateurs to use the amateur facilities from space. There should not be any special permission that allows them to operate on amateur frequencies without being amateurs. I know of no earthly reason . . . or "spacely" reason for that matter . . . why an Extra-class license should be required, however, to transmit from space.
>
> I think the code is an important communication mode, but I don't really believe it should be so central to amateur licensing. I plan to get an Extra-class license when I get my code speed up. I enjoy CW, but it is hard to find the time to do it. When I worked HF I did about half CW. I would be in favor of having part of the [ham] bands digital or code and preserving parts of the bands that different classes could use without code knowledge.
>
> I am concerned about the importance that the amateur community places on an Extra-class license and the perception of incoming amateurs of that importance. If I am a new person starting and I know a lot about electrical engineering and everyone is telling me that the highest honor in amateur radio goes to someone who can send code at 20 words per minute, I would begin to wonder where their priorities are. What is this amateur radio really about?
>
> I think there ought to be alternate ways that if someone excels in certain areas that are recognized as important to amateur radio and can demonstrate that through an exam . . . or whatever . . . they should earn the high honor of being an Extra. If it is important to limit certain parts of the band from certain kinds of communication . . . well that is not involved with licensing, that is involved with what technique you use on what part of the band.

How many more youngsters would we get with a no-code ham license for operation, say, on 220 MHz? We don't have any idea. But we have so little to lose by trying it and so much to gain—such as the possible saving of amateur radio—that it's worth a try.

CANADIAN NEWS

The Canadian Radio Relay League has been cut loose from the ARRL at long last. Will this allow Canadian amateurs the freedom to get amateur radio growing in Canada? The CRRL dues now stay in Canada, with the CRRL buying *QST* for its mem-

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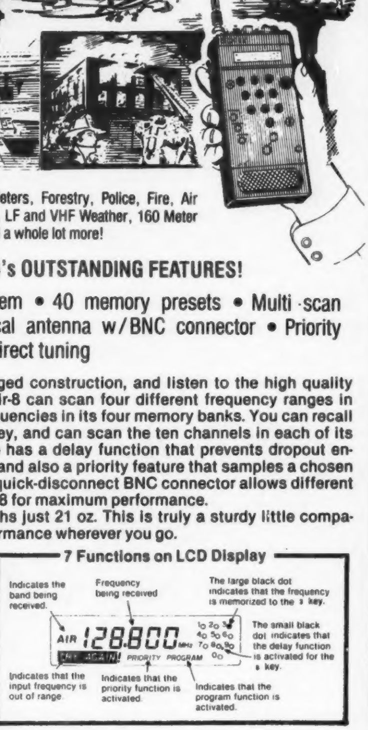
6 Frequency Bands

Band		Frequency range	Tuning interval
PSB		144 - 174 MHz	5 kHz
AIR		108 - 136 MHz	25 kHz
FM		76 - 108 MHz	50 kHz
AM	SW	1601 - 2194 kHz (1603 - 2194 kHz)	1 kHz
	MW	530 - 1600 kHz (531 - 1602 kHz)	10 kHz (9 kHz)
	LW	150 - 529 kHz (150 - 530 kHz)	1 kHz

7 Functions on LCD Display


Indicates the band being received.
Frequency being received
The large black dot indicates that the frequency is memorized to the 3 key.
AIR 128.800 MHz
1 2 3 4 5 6 7 8 9 0
The small black dot indicates that the delay function is activated for the 8 key.
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PROGRAM
Indicates that the input frequency is out of range.
Indicates that the priority function is activated.
Indicates that the program function is activated.

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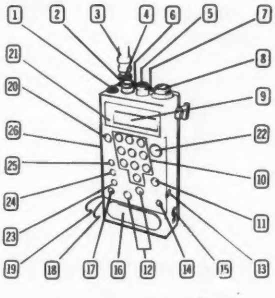
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bers and having it sent to them from the U.S.

The CRRL now handles its own membership records, handles its own finances, maintains its own offices and paid staff, etc. They're also breaking with ARRL tradition in looking into a new class of membership which will not include *QST*. This is due to the very high cost of *QST* in Canada, which they feel cuts seriously into their membership potential.

Negotiations are underway for a merger of the CRRL and the CARF, with the two being reborn as The Radio Society of Canada. With these remarkable changes, the purposes of the CARF would seem to have been achieved, so perhaps the two can now merge. This would provide Canada with a single strong organization which could then devote its energies to building the hobby in Canada.

MINNESOTA

They had a great little hamfest in Minneapolis in November—too bad if you missed it. Perhaps, if you're within driving distance, you can organize yourself and your family to make it next time.

The hamfest is on Saturday, so if you do some planning ahead you might also be able to get over to the *Prairie Home Companion* show in St. Paul. The hamfest ends up at 3 p.m., leaving you plenty of time to putt on over for the show by 5 p.m.

You'll hear why *Lake Wobegon Days* has been on top of the book list for a year now as Garrison Keillor spins his yarns. You may get like me and not only tape his stories every week, but buy his cassette yarns, too. If you haven't read the book, do it. Unless you have a special problem, you'll love it. I realize from my mail that we do have some hams who are angry people—who must be hell on wheels with which to live. I wince when I get an abusive letter from people who must be terrors to be around. I'm sure they don't single me out for their abuse.

Now, back to the Minneapolis hamfest which was held in a school in Richfield. It was just about right for the ham dealers and computer stuff exhibitors—plus they had a good large room for me to talk in. I'd judge there were maybe a couple thousand attending the hamfest—which didn't crowd the place too badly at all. I was disappointed to listen on 2m and hear many hams who weren't bothering to go to the hamfest. I'd sure like to see a hamfest some time when every live ham within easy driving distance made it his or her business to be there—like in the old days.

While I was there I recorded five interviews for *Gizmode*, a high-tech program which airs at 7:30 a.m. (yawn) Sunday mornings on KSNE (1280 kHz). You might want to check this out if you're in the Minneapolis area on Sundays. It's also on the K-SAT satellite radio network.

I'm planning on getting down to Orlando in March and I expect every ham still able to get out of a chair to be there to say hello. I expect I'll be speaking, too, so on the off chance I have something of interest to say, allow some time. Okay? Sometimes I'm pretty good. Sometimes I ain't. You take your chances. If you come and just sit there dozing off, so will I. If you come loaded for bear, we'll have a great time.

The Minneapolis crowd was semi-alive, so it wasn't a total loss. I brought along an 8mm video camera, so we've got it on tape. I'll try to tape my next couple of talks in Dallas and Las Vegas—combining the three I may end up with something to send out for club meeting entertainment. . . or punishment.

Hamfest chairmen, your biggest challenge is to get your local hams off their fat butts. Can you figure out something so great to do at your hamfest that they'll shut up on the local repeaters for a couple hours and mosey on down? Good luck.

If local dealers loaded with ham gear bargains, tech sessions, and prizes won't budge 'em, you've got some brainstorming to do. We don't have many well-known hams these days, so it's difficult to bring in headliners to talk. Barry's busy most of the time. I'm pretty busy, too. Which leaves an astronaut or two. . . Tony and Owen. Beyond that. . . ?

I'm doing the best I can to get to hamfests, but I'm spread far too thin. So far this year I've talked at Miami, Orlando, Atlanta, Dallas, Garland, Las Vegas, San Diego, Dayton, Minneapolis, and Boxborough. Get off my back! I have to do some work, too, you know.■

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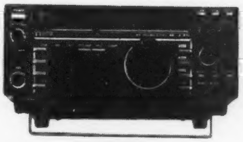
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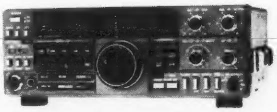
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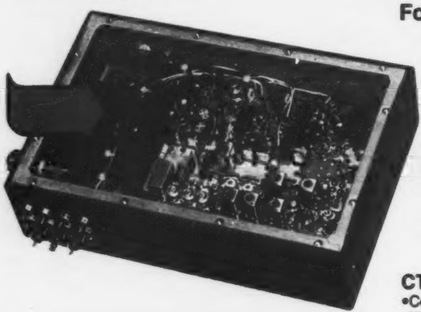

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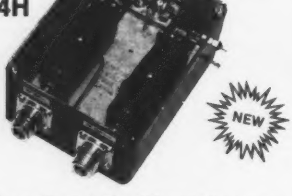

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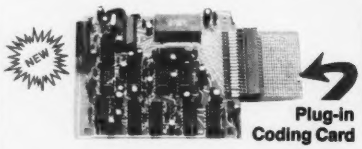

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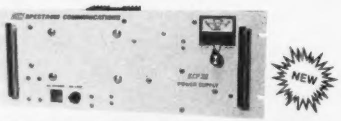

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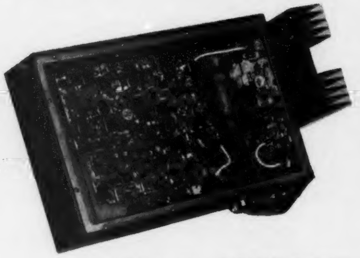

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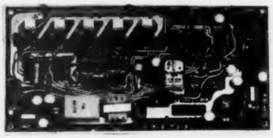

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WB8DQT FAN

I was just about to drop my *73* subscription when along comes WEATHERSAT—great! For me this makes *73* a great ham magazine again. I can hardly wait for the next issue.

Dale Hauck, M.D. W6YFT
Los Angeles CA

IN THE AIR

I am not a ham yet but some day I would like to get my ticket. I have a mental block (or is it constipation?) of the brain keeping me from mastering the code. Theory should be no problem, as I'm an Avionics Communications Specialist in the Air Force and I get to work on HF, VHF, and UHF equipment—not only on the bench, but in aircraft installations.

The people that I work with think that I'm crazy for being into radios so much. I love it and can't get enough experience or my fill of the stuff. My wife is into cameras and computers, and together I know we could both have a blast being hams. I'm also trying to get my kids interested and expand their horizons. The day that I brought a Kenwood R-2000 home and hooked it up my boys were glued to it. It made me feel like a million bucks when I found out that they sneak in and listen to it. Just like my daughter, who gets out my code-practice oscillator and plays with it. It would be great to have five callsigns at this QTH!

An even bigger influence is the fact that I'm stationed at Yokota Air Base in Japan, with my wife and kids here also. Ham radio is "in the air" over here. Yokota is located by the city of Fussa-shi, which has a train straight to Akihabara! If the yen ever straightens out, I hope to go there often. I'm looking forward to that day.

Robert Aldridge
APO San Francisco

Robert, I just don't buy the excuses I hear from people about why they can't learn Morse code. You and everybody else in your family are physically and mentally capable of learning it . . . but you have to actually work on it. I've found that most folks who complain that they can't learn code expect it to just "happen" in their mind immediately, without effort. And that includes the "strugglers" who agonize over every new character—they are so embarrassed that code isn't easy that they spend all of their time worrying about their ego instead of just learning the letters.

So, my advice to you is to stop worrying that you can't learn the code. Of course you can learn it. Everyone can. Relax and work on it a bit at a time. Have a beer while you're listening to a code tape, or take a nice hot bath. If you can stop being so uptight about not being able to do it, you'll be amazed at how quickly you'll pick it up.—KW1O.

WAXING

I've just received my first issue of *73* (October) on a new subscription. I read this issue from cover to cover and have never found *QST* to be as interesting. I am so glad that Wayne is back that I felt obliged to write you this note to tell you so.

My interest in ham radio has been on the wane these past few years and, as such, I have not been too active. I look forward to the following issues of *73*, and for the renewed interest in amateur radio I thank you.

Bud Lieberman WB2WSZ
Hackensack NJ

De nada.—Eds.

RENT-A-WAYNE

I just heard your excellent talk in San Diego, Wayne. I wish more clubs could afford to hire you to come and talk to them. Maybe you should make a tape and rent it or loan it to clubs to get them stirred up!

Gib Gibson W7JIE
Renton WA

You're right, Gib, a video just might help. I'll try to tape my next couple of talks and see if anything useful develops which could be made available for clubs. I've got a couple of VCRs so I can make VHS copies of my 8mm tapes.

I got a letter from one admitted Wayne Green hater who wrote to say that he saw a video of my talk in L.A. and hated that too!—Wayne.

TRULY DOOMED

I just picked up the September, 1986, issue of *73* and read Never Say Die. I was very disappointed and ashamed of the image you presented of a ham radio operator. In the first place, I fail to see what a discussion of one's personal success has to do with ham radio. It is very disappointing to see that you apparently measure a person's success by the dollars he or she makes—the car one drives or how much one is willing to fork over for a subscription to your magazine. How absurd.

I am fairly successful in your own warped terms. I do, however, have many friends who are not as financially well off, but who are no less a success. Many people work very hard and contribute a great deal to society and/or the country and are not fairly compensated. Soldiers give their lives for an embarrassingly small salary.

If you truly believe that you can't consider a person successful if he/she can't spend the bucks to subscribe to *73*, then that is a sad statement of your character as a ham and as a human being. Ham radio should not be a hobby with a financial prerequisite. It should be for anyone who has the drive to get the license and who will promote the goals and principles upon which the hobby is based. One of the goals you have forgotten in pursuit of the dollar is goodwill. If you represent the future of ham radio, we are truly doomed.

Norman Joe Korpela
Portland OR

Apparently 20-wpm code has zapped your brain. When you suggest that someone, who may be a lovely person but who is so out of step with our society that he/she is starving to death, be considered a success, we do have a religious dispute. I've never had any personal interest in money, but I'm not dumb, so I've come to grips with the fact that my businesses have to be profitable if I'm going to start more of them—providing more people with work. Nowhere in my editorials will you find me suggesting that everyone should sacrifice themselves to get rich, but you will find me urging every reader to go into business so he/she will be able to buy the things he/she wants—such as ham gear, an occasional DXpedition—even a subscription to 73. Norman, give up the code before it gets worse.—Wayne.

TOO MANY

Much is being said these days about the need to liberalize the requirements for an amateur radio license. I say that the amateur service is fast becoming worthless to all of us due to the enormous number of licenses granted by the FCC! This fact is very obvious on the HF bands where intense interference is commonplace; too many stations are trying to fit into a finite spectrum.

Here are some alarming facts that you must be aware of: In 1971 there were about 250,000 hams. Today there are almost 500,000 (good statistics to show publishers of ham radio magazines who say the hobby is in a state of demise). And there are more Extra- and Advanced-class operators than all the other classes put together! The FCC should reduce the number of licenses granted by increasing the technical requirements for a ham ticket.

David Danello WB4ONS
Blacksburg VA

David, it's pretty obvious that you don't know what you're talking about. My guess is that you're using a junky receiver which you don't know how to use in the first place. If you're so hot for wide open spaces, try 10 meters—although I've heard some openings up there during the day which certainly sounded like a crowded band. You could always disconnect your antenna and listen to receiver noise.

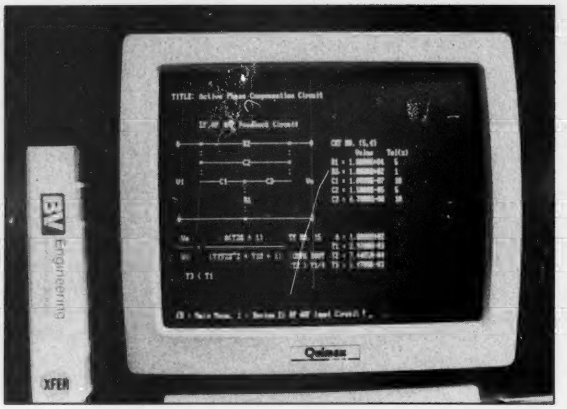
As for you alarming facts, here's what's really happening: There are just over 423,000 hams, not 500,000. If our research is correct, about 10% of the hams in the FCC computer are dead, so figure there's around 380,000 living amateurs. There are roughly 140,000 Extra- and Advanced-class licenses outstanding, and the rest combined total around 280,000. Last month saw 0% growth in the ham ranks, and it'll stay that way until we have a working no-code license in place.—KW1O.

NEW PRODUCTS

Number 21 on your Feedback card

KENWOOD
4.200

The Kenwood TR-751A.



XFER transfer function analysis from BV Engineering.

KENWOOD TR-751A

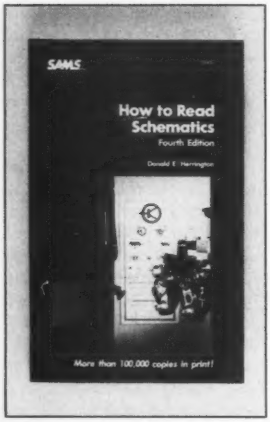
Kenwood's newest two-meter all-mode mobile transceiver offers 25 Watts of output from 142–149 MHz (modifiable to cover 141–151 MHz), automatic mode selection, a GaAsFET front end, 10 memory channels, all-mode squelch, dual digital vfo's, and semi-break-in CW with a sidetone. Options include Digital Channel Link, a VS-1 voice synthesizer, and a 38-tone CTCSS encoder.

For more information, visit your local Kenwood dealer.

SCHEMATIC HELP

The fourth edition of *How to Read Schematics* by Don Herrington is now available from Howard W. Sams. The new edition has been revised to include logic diagrams and flowcharts. The book moves from a general overview of electronic diagrams to the specific components of a circuit, detailing the techniques used to follow complicated schematics.

How to Read Schematics retails for $14.95 and can be found in most bookstores; for information about this and other Sams books, check Reader Service number 205.



Schematic-reading help from Sams.

BVE XFER

BV Engineering has released a transfer function analysis and synthesis program for the IBM PC and compatibles. XFER uses short-circuit transfer impedance functions around an op amp to compute circuit elements and configurations to yield a given transfer function. The program will also calculate a transfer function given the values of the circuit components.

XFER is menu-driven and uses free-format input. Files generated by XFER are compatible with other BV Engineering programs such as SPP, PCPLOT, PDP, and TEKCALC. XFER files can be used as an input to SPP to perform transient and time-domain analysis of user-generated waveforms.

For more information on BV Engineering software, check Reader Service number 215.

REPEATER DEMO TAPE

Advanced Repeater Controls has introduced a new audio cassette which describes and demonstrates their repeater control products. Included in the demo are the RC-850 and RC-85 repeater controllers, the ACC Digital Voice Recorder, and the ITC-32 Intelligent Touchtone™ Control board.

The tape is perfect for club presentations and is available at no cost directly from ACC. To request a copy, contact ACC, 2356 Walsh Avenue, Santa Clara CA 95051; (408)-727-3330.

DISH INSTRUCTIONS

A new book from Power Gain Systems, *Build Your Own Satellite Dish Antenna*, gives step-by-step instructions for constructing a 10-1/2-foot dish antenna—including photos, illustrations, and sources for materials.

The book is $12; for complete details, check Reader Service number 207.

COMPACT VOM

Mercer Electronics, a division of Simpson Electric, has announced

mercer
9101

Mercer's model 9101 pocket DMM.

PRODUCT SPOTLIGHT

Here's our favorite new offering this month:

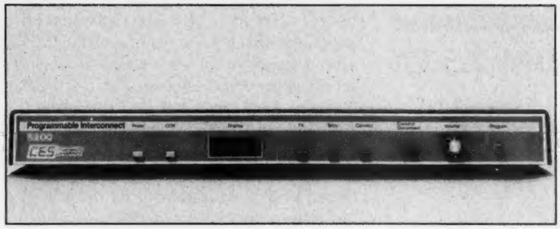
KAM
Kantronics All Mode

KANTRONICS KAM

Kantronics has introduced KAM™, an all-mode digital communications interface. KAM is a radio modem with RTTY, AMTOR, packet, ASCII, and CW built in. The unit is compatible with any computer that has an asynchronous I/O port.

KAM features over 100 software commands, a bar-graph tuning indicator for RTTY and HF packet, a switchable limiter, programmable center frequency and bandwidth for CW, two radio ports, and programmable mark and space tones for RTTY.

For complete details, visit your local ham store or check Reader Service number 212.



The CES model 5200 Programmable Interconnect.

a small VOM with 27 ranges, including a 100-megohm range, priced at $29. The model 9101 is 5-1/4" x 3-1/2" x 1-1/2" and weighs only 9 ounces. Its 27 ranges measure up to 1,000 V dc, 1,000 V ac, 500 mA dc, 100 megohms resistance, and −20 to 56 dB. Sensitivity is 20,000 Ohms/volt dc and 8,000 Ohms/volt ac.

The model 9101 comes with batteries, test leads, and an operator's manual; for complete details, please check Reader Service number 206.

KENPRO INTERFACE

Encomm, Inc., has announced an interface which will allow a computer with a serial port to control the azimuth and elevation settings of Kenpro's KR-5400A and KR-5600A rotor. The KR-010 contains analog-to-digital converters for both the azimuth and elevation channels and also provides the drive signal to turn the motors in the proper direction. An internal microcomputer provides RS-232 serial capability at 9,600 baud with no handshaking. The KR-010 operates with tracking software written by W3IWI and W0SL for AMSAT (available only from the AMSAT software exchange).

Suggested retail price is $269.95. For more information, please check Reader Service number 216.

CES MODEL 5200 PI

The CES model 5200 is a new interconnect unit that may be programmed locally or remotely with DTMF signalling. The device is expandable to up to 250 ANI codes, and features multiple-format encoding (CTCSS, two-tone, five-tone, DPL, 2805, and MTS), toll restriction by user, DID for mobile selective signaling, a clock and calendar for usage billing, and a dial click detector.

For information on the complete line of CES communications equipment, check Reader Service number 211.

ICOM IC-275

ICOM America has announced the new IC-275A/H multimode 2m transceiver. The rig covers 138–174 MHz (transmit from 140.100–150.000 MHz) with 25 Watts (IC-275A) or 100 Watts (IC-275H) output. The 25-Watt version comes with a built-in power supply, while the IC-275H requires an optional external supply.

Other features include 32 built-in subaudible tones, variable offsets, 99 tunable memories, and a call channel.

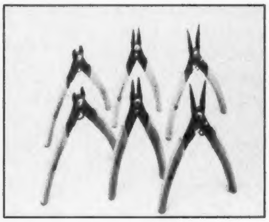
Both radios scan the entire frequency range, and can scan all memories (20 per second) or a pre-programmed group of frequencies. Options include a tone squelch unit, a speech synthesizer, a module to lock the IC-275 and its companion IC-475 together for OSCAR operation, and a CW filter.

The suggested retail price for the IC-275A is $1,199; for more information, visit your local ICOM dealer.

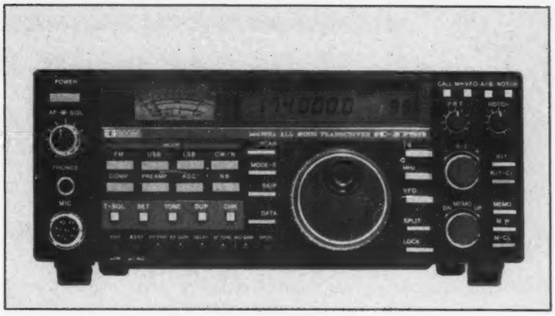
DAVLE TECH TOOLS

Davle Tech, Inc., offers a full line of precision cutters, shears, pliers, crimpers, and benders for the electronics hobbyist. All of the tools feature contoured ribbed handles, which provide a non-slip gripping surface, and a return spring to help eliminate operator fatigue.

For information on the complete line of Davle Tech tools, check number 213 on your Reader Service card.



Davle Tech hand tools.



ICOM's IC-275A 2m multimode.

ATC GUIDE

Cambridge Airadio Services has published a guide to shortwave air traffic control frequencies in the 2–22 MHz range. Aircraft use HF communications for long-haul traffic and when out of range of VHF stations. The book explains the various ATC communications that can be heard, and lists channels in frequency order and by country.

For complete details, please check Reader Service number 214.

FREE MIDIAN CATALOG

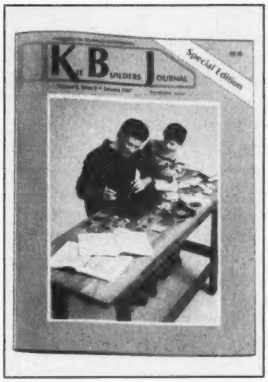
Midian Electronics' 1987 full-color catalog featuring tone-signaling products is now available. Also listed are microprocessor-based paging systems, and radiotelephone terminals.

For your free copy of Midian's new catalog, please check Reader Service number 217.

HEATH MAGAZINE

Heathkit has announced the publication of *Kit Builder's Journal*, a magazine covering all aspects of electronic kits and kit building. The journal will offer tips, news, reviews, and advice from Heath's technical consultants. Subscribers will receive special discounts on selected Heath products.

A one-year subscription (six issues) is $9.95; order KBJ-2000-NM from Heath Company, Box 1288, Benton Harbor MI 49022; (800)-253-0570.

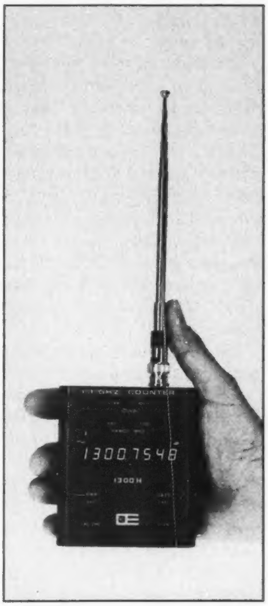


New magazine offered by Heath.

1.3-GHZ POCKET COUNTER

OPTOelectronics has introduced their model 1300H pocket-sized 1.3-GHz frequency counter. Housed in a case 3-1/2" x 4" x 1", the counter comes with rechargeable NiCd batteries and an ac wall adapter. Resolution from 1 MHz to 1.3 GHz is 1 kHz with a .25-second gate and 100 Hz with a 2.5-second gate. Accuracy is ±.00001%.

For more information about OPTOelectronics frequency counters, check Reader Service number 209.



OPTOelectronics' model 1300H.

73 Review

ICOM 751A

by Marc Stern N1BLH

ICOM America, Inc.
2380-116th Avenue NE
Bellevue WA 98004
Price class: $1,649

Number 9 on your Feedback card

ICOM has always had a sensible new-equipment policy: Never release a new rig until the lifespan of an older model is finished. This policy has probably saved the sanity and marriage of more than one operator because the cost of a new rig can be spread over several years before a new version hits the market.

Considering this, then, you can imagine my surprise when the improved IC-751A appeared in ads, superseding the current IC-751 as ICOM's top-of-the-line rig. After all, the 751 was introduced about three years ago and seemed to still have some life left. So, you can also imagine my desire to get my hands on the newer version to see if the rig has changed.

Comparison to the IC-735 . . .

After using the 751A for an extended period, I can say that there are some changes. The 751A is built upon the technology of the 735 (reviewed in November, 1985) to create a virtually new rig.

You really wouldn't think the 751A is a new rig from the outside because it looks just like the older 751, right down to the 35 knobs, control switches, and buttons on the front panel. It also has the same 105-dB dynamic range, continuous receive coverage through 30 MHz, multimode (AM, FM, CW, and SSB) capability, nearly the same LED display (with a couple of additions), and 100 Watts of output power.

But, if you were to continue thinking like that, you would be making a mistake. The new 751A has more in common with ICOM's other state-of-the-art rig, the 735, than it does with the older 751. In fact, comparing the schematics shows that with the exception of a couple of integrated circuits, the 751A and 735 are just about the same. The key difference in circuitry is that the customized microprocessor in the 735 controls a multifaceted liquid crystal display (LCD), while the 751A uses a multicolored light-emitting diode (LED) display.

Both radios take advantage of newly developed central processing units for control. This means the 751A is highly versatile, like the 735. For example, the new CPU allows monitoring of all 32 memory channels or only those storing a particular mode—FM, for example. Further, the programmed scan feature allows scanning between any two programmed frequencies. In all cases, though, the auto-stop feature of the 751A halts scanning until a QSO has finished and then automatically resumes when the frequency is clear.

This is like the 735's capability. The chief difference between the two is the fact that the 751A has 32 memories and two vfo's, while the 735 has 12 memories and two vfo's. The 735 also has an internal fan and no heat sink, while the 751A has a huge heat sink and an external fan.

In fact, the 735's fan comes on after a short time of heavy use, while the fan in the 751A remains off. This is due to the size of the heat sink. Further, the 735's fan is variable, meaning that the higher the demand, the higher the fan speed. This makes the 735's fan obtrusive at times in a quiet shack. The fan on the 751A, on the other hand, is quiet and only comes on when needed. In fact, it's barely noticeable under most circumstances.

. . . And to the IC-751

To be fair, though, the real comparison should be with the older 751, the rig that the 751A replaces. The key difference between them is important—program storage. As for other specifications, they are pretty much the same. For example, the new 751A's dynamic range is 105 dB, as is the 751's. The power requirements are the same—13.8 V dc; the usable temperature range is the same—14 to 140 degrees F; the display resolution is the same—to 100 Hz; spurious emissions are down more than 60 dB, as well as having harmonics down more than 40 dB; sensitivity is better than 0.5 uV; and selectivity is better than 2.3 kHz for SSB, CW, and RTTY at −6 dB.

The specifications, then, match them well. But, the two 751s are different. In the 751, ICOM used dynamic random access memory (DRAM) to store program and frequency information. The DRAM was backed by a lithium battery, whose average life was figured at about five years. Once the battery died, the programming disappeared due to the loss of power to the memory, and the rig had to be sent back to the factory for reprogramming. Just about all the older ICOM microprocessor-controlled models used this plan.

Evidently, ICOM has seen the light because it now stores its programming in nonvolatile memory. The only volatile memory is user memory, which contains the frequencies you've programmed as well as the modes. The lithium battery now backs up this user scratchpad. It's quite an improvement and shows that ICOM is willing to listen to consumer input.

Improvements

Looking at the 751A you wouldn't think anything has changed at all. The reason, quite frankly, is that the boxes look alike. However, when you look closely at the front panel, you begin to see some of the changes that have been implemented. For example, the 751A is an improved CW rig. It now sports an electronic QSK keyer that is capable of up to 40 wpm. It also has a standard 500-Hz CW filter and a CW sidetone monitor, so you can monitor your code in transmit and receive.

Another improvement over the 751 is an added LED annunciator in the display. The new annunciator indicates whether you're using the tuning dial or bandswitching functions. The 751A also has smoother tuning. While the 751's tuning was good, the 751A's tuning is even better. It feels silkier and features a newly designed tuning knob.

Many of the improvements, however, are "under the skin." For example, the new 751A is even more stable than the 751 thanks to a new thermal sensor that monitors internal temperatures. The sensor automatically turns on the fan which, in turn, ensures that there's no thermal drift.

Further, the new model boasts a 9-MHz notch which drastically reduces QRM. In fact, just using the passband tuning control and the notch filter will be enough to knock out any QRM on a particular signal. The 500-Hz CW filter is like icing on the cake. And, in some cases, I wonder if you really need the filter.

Other worthwhile improvements over the 751 are a new agc system, new compressor circuitry for better audio, and a new af gain control system, which improves control of CW sidetone volume.

With all these improvements, though, there are a couple of important items to note on the CW keyer and the noise blanker. The CW keyer speed control is decidedly nonlinear. Like many analog meters, large changes in speed are crowded into small spaces on the dial. This means that it's tough to find precise speed control toward 40 wpm. Further, at 40 wpm the weighting tends to become shaky and imprecise. The QSK feature is a nice addition, but for most operators it's probably overkill.

The 751A features a selectable noise blanker which eliminates all but the most stubborn wideband and narrowband noise. (I have a source near my house that's virtually impossible to eliminate, but the blanker managed to get a good chunk of it.)

But, while it's a nice feature, it's not without problems. At its highest settings, it causes CW signals to become distorted, almost keyclick-like in tone. It's something you should be aware of if you're planning to buy this radio. However, it isn't a major problem because most of the time you'll probably operate the noise blanker at a lower setting.

Conclusions

Overall, then, the 751A is a worthwhile improvement over the older 751. It corrects some of the flaws that were readily apparent in the older version and improves upon the radio's already solid basic features.

If you're looking for a new HF rig that combines general coverage and multimode capability, look at the 751A. You won't be disappointed. ■

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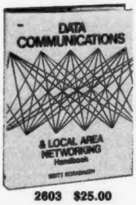
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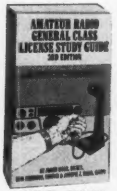
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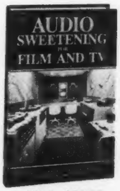
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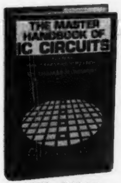
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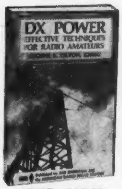
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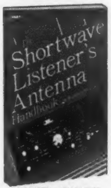
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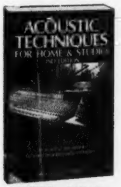
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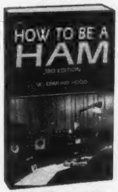
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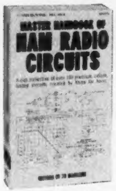
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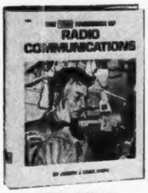
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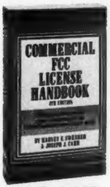
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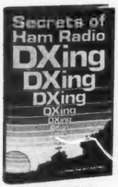
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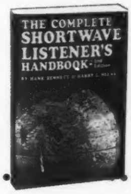
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144-MHz Antenna Test: Three For Two

by Peter H. Putman KT2B

Cushcraft 32-19 and 42-18XL Boomers
Cushcraft Corporation
PO Box 4680
Manchester NH 03108
Price Class: 32-19 $140
42-18XL $150

Tonna F9FT 17-Element Yagi
The PX Shack
52 Stonewyck Drive Belle
Mead NJ 08502
Price Class: $120

Number 10 on your Feedback card

Last year was a grand one for French and American relations, owing to the 100th anniversary of the Statue of Liberty. With that in mind, it seems entirely appropriate to review these products—the premier 144-MHz yagis from two of the best-known names in antennas here in the United States and in France.

Cushcraft Corporation of Manchester, New Hampshire, has long been known for their 32-19 19-element "Boomer," as it has come to be known. This is one of the most popular antennas in the world for weak-signal work on 2 meters, and its popularity supports its performance and durability. Recently, Cushcraft introduced the 42-18XL 18-element yagi, using a 28-foot boom for that extra 1 dB of gain, based on the 19-element version.

Antennes Tonna of Reims, France, is no stranger to the weak-signal world either! Many of the top operators in Europe employ their 17-element yagi stacked in H-frames for contest and EME work. Tonna has long been known for their innovative square booms and easy product assembly, and is now making inroads in the U.S. market. The comparative figures for each antenna are listed in Table 1. Note that gain figures are based on manufacturer's claims.

Representative models of these yagis were obtained "off-the-shelf" for the purposes of this review. The F9FT Tonna arrived about the same time UPS dropped two big boxes from New Hampshire on my doorstep, and I commenced with the project.

Assembly

The F9FT Tonna comes with the various elements bundled together with tape. The boom sections (four of them) are marked with colored tape at the ends to aid in matching the correct boom sections quickly. On all Tonna antennas that I've used, one end of the boom has a red cap and the other a black cap. This matches the boom brace as well.

As mentioned earlier, Tonna employs square boom material. This makes assembly much easier, as you simply snap the element into a molded plastic mount (the center of each element is marked with a crimp), then fasten the element to the boom with a wing screw and nut. The mount is channeled to fit securely to the boom. Incidentally, all of the mounting hardware is separated into various bags. This is a big help as you don't need to sort out all of the hardware you don't need at the moment to get to what you do need. All hardware is stainless steel except the boom-to-mast clamps, which are galvanized.

The driven element is pre-assembled and tested at the factory. It also fastens with one wing screw to the square boom. The trigon reflector assembly attaches with pre-threaded steel plates and wing screws. You really need only a 10mm wrench to assemble the whole thing, and Tonna includes 2 brackets to accommodate up to a 2" mast. One is also fitted snug to the square boom, and the other is attached to the brace. Incidentally, the

Photo A. The Tonna F9FT 17-element yagi.

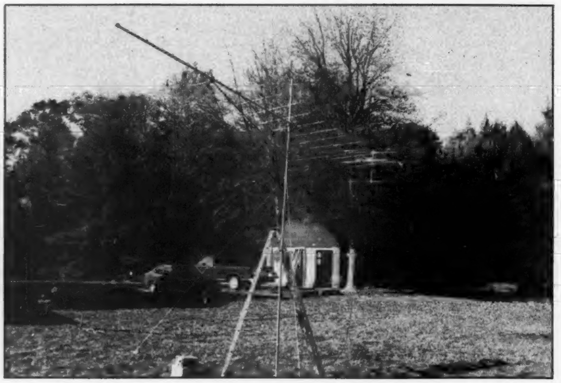

Photo B. Cushcraft's 32-19 Boomer.

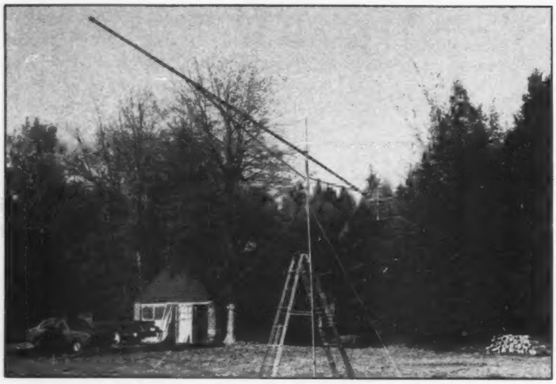

Photo C. Cushcraft's 42-18XL Boomer.

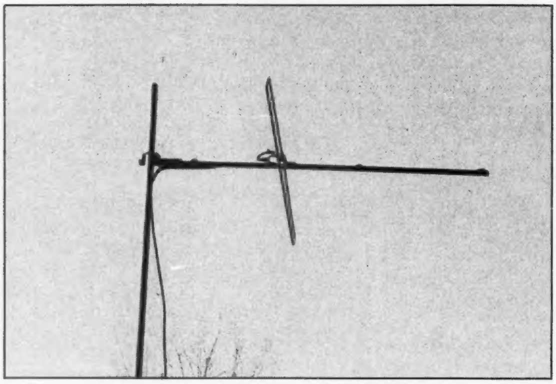

Photo D. Test source antenna at 15 feet.

brace also is made from square aluminum stock.

The 32-19 Boomer also comes with the various elements bundled together. Unlike the F9FT, however, all of the hardware is together in one big bag. This is a pain in the neck since you must inventory all of the parts for the antenna first before starting assembly. You also run the risk of using the wrong screw in the wrong place (as I did) as well as even losing a nut, washer, or screw someplace (which I also did).

The boom sections are constructed from 1-1/4" aluminum tubing, which is fairly strong material. The boom braces are made of 1-1/8" and 1" tubing. All hardware used is stainless steel including the boom-to-mast clamps. Note that the boom sections are not color coded, and you must measure the pieces carefully to make sure you have them in the right order. (This is less of a problem than on the 42-18, which we'll get to in a moment.) Stainless hose clamps and screws are used to secure the various sections together.

You'll need an 11/32, 5/16, and 7/16 nutdriver to assemble this antenna. Make sure you have a clear and clean work area (a paved driveway is best, since loose nuts and screws show up easily) with enough room to turn this antenna around as you work. The driven element requires assembly, although the tap points for the T match are indicated with a marker. The trigon reflector attaches with a pair of clamshell-type clamps and screws. It must be aligned carefully! Each element attaches with a special clamp and support bracket, ensuring correct alignment on the boom.

The 42-18XL Boomer is a huge beast and requires a lot of room for assembly. Again, as in the case of the 32-19, all of the hardware comes in one big package and you must presort before starting assembly. Boom sections are constructed from 1-1/2" material with 1-1/4" sections attached, so it is somewhat heavier than the 32-19. All hardware supplied is stainless steel, including the hose clamps and boom-to-mast clamps. The trigon reflector attaches to the boom in the same manner as it does with the 32-19.

Again, you'll need 11/32, 5/16, and 7/16 nutdrivers to assemble this antenna. A screwdriver would also help. As on the 32-19, the boom sections are not marked, and since two of them are of different lengths, they can easily be confused (as I did). Measure carefully and mark the adjacent sections with different colored markers. You'll also need to construct the T match yourself, and the instruction guide tells you where to make the tap. It's not marked as it is on the 32-19.

Let's now review some observations regarding construction. It took me about 45 minutes to assemble the F9FT—it's that easy. The 32-19 Boomer took about 1-1/2 hours, while the 42-18 took about 2 hours. The 42-18XL was the most complicated assembly I've seen in a long time! In addition, I wound up short two sets of screws and nuts on the 32-19, while the 42-18XL had two extra sets (how convenient!). The F9FT wound up with one extra wingscrew, holder, and nut assembly.

	F9FT 17	32-19	42-18XL
Length	21' 6"	22'	28' 9"
Weight	14 lbs.	12 lbs.	14.3 lbs.
Feed Imp.	50 Ohm	50 Ohm	50 Ohm
Frequency Range	138.0–148.7	144.0–146.0	144.0–145.0
Forward Gain	15.3 dBi	16.2 dBd	17.2 dBd
Front/Back Ratio	36.9 dB	24 dB	24 dB
Sidelobe Attenuation at 90 deg.	>50 dB	>60 dB	60 dB
Connector	Type N	SO-239	SO-239
Matching Network	T Match	T Match	T Match
Swr at Frequency	1.2:1	1.2:1	1.2:1

Table 1.

Measured	F9FT	32-19	42-18
Test Source	+4.5 dB	+4.5 dB	+4.8 dB
(Reference Signal) Sidelobe	−38 dB	−32 dB	−38.5 dB
Rearward Lobe, Max.	−15 dB	−13 dB	−12 dB
Feedpoint Swr	1.3:1	1.2:1	1.3:1

Table 2.

Measurement	F9FT	32-19	42-18
Sidelobe Rejection	−42.5 dB	−37.5 dB	−43.3 dB
F/B Ratio	19.5 dB	17.5 dB	16.8 dB

Table 3.

When the F9FT is done, all sections are rigid, including the boom brace. You merely lift it up to the mast and attach the U-bolts, which is a big advantage of using square boom material. The 32-19 is somewhat floppy, and I suggest making the final adjustments on the boom brace after the main boom is attached to the mast. The boom brace-to-mast clamp is kind of fishy and twists on you while you're tightening it. The 42-18XL is also floppy, and the same procedure is suggested for final brace alignment.

With the F9FT's square boom material, it's a snap to make sure all elements are plumb, in line, and 90 degrees from the vertical plane. Using round tubing does make this job somewhat more difficult, but the elements on the 32-19 were also extremely plumb and in line. The drilling job on the 42-18 was, in my opinion, substandard. At least four elements were not in line, as was one of the two trigon reflectors. How much difference would this make? We'll find out in the measurements!

As far as mechanical integrity, I have no doubts about the 32-19 and F9FT standing up to a good wind. Simply put, the F9FT doesn't offer much wind resistance, and the 32-19 boom material is a good strength for the boom length. The 42-18XL is made of much heavier material and offers a bit more target for high winds, but should survive most bad weather conditions. Keep in mind that the 42-18XL is 28+ feet long and will "twist" more in a breeze. Construction of the F9FT and 32-19 both rate very high. The 42-18XL drops a few notches due to the poor drilling job.

Test Setup

Moving to the field resulted in interesting data. I decided that to try making forward gain measurements would be pretty nigh impossible given my modest setup. What I elected to do was measure the difference in a given gain figure between the antennas as well as check front-to-back ratio (F/B) and sidelobe rejection at the 90-degree point. In addition, I verified the feed impedance claims as well. I decided to set each antenna up on a 15' piece of masting with nylon guys and sliprings for rotation.

Now, one big problem is that 15 feet is not really enough to make this measurement—it probably ought to be more like 25 to 30 feet. However, I wasn't in a position to use 25 to 30 feet of masting and climb up and down mounting to remove the various beams, so 15 feet it was. Since the antennas exhibited such similar claims for gain, F/B ratio, and sidelobe rejection, I suspected that incidental ground effects at 15 feet would affect all three antennas about the same, and the resulting data would have some merit.

The rf test source was easy: My Kenwood TR-9000 with the Lo-power switch on was set to exactly 1-Watt output, as measured with the Bird 43 Thruline meter. The source antenna was the folded dipole driven element from a KLM 4-element yagi also mounted at 15 feet (see Photo D). This was located exactly 70 feet from the test yagi mast.

The test yagi mast was carefully located more than 30 feet from any trees, metal objects, and cars so as to minimize reflections from these sources. The only effects would be ground reflections as I mentioned earlier. The procedure used was to attach the particular yagi in question, set the power to 1 Watt on the exciter, then take careful measurements for maximum forward gain, maximum null at 90 degrees to the rf source, and peak the measurements off the back to establish an F/B ratio.

My assistant (my brother Miles) helped me to make sure the booms were level when tightening the braces and also operated the mast using a vise-grip while I checked the readings on a Boonton Model 902 rf millivoltmeter.

Results

Photos A, B, and C show the F9FT, 32-19, and 42-18, respectively, undergoing measurements. Table 2 contains the resultant data. As you can no doubt tell, ground effects were certainly evident. As you also can tell, they seemed to affect each antenna about the same, so that no one yagi had an advantage over another. What can we deduce from these measurements? First of all, it would appear that the F9FT and 32-19 are about dead even in terms of forward gain, whatever the actual number is (and the claimed numbers are 15.3 dBi vs 16.2 dBd, respectively). The 42-18 showed a modest increase in gain—only .3 dB—and I attribute that mostly to some ground effects. No doubt the misalignment of several of the elements had some effect as well.

Take a look at Table 3 for some other interesting data. Again, the effects of ground reflection are apparent. It seems safe to say that one may assume each antenna to have greater than 50 dB of sidelobe rejection.

Cushcraft claims 24 dB F/B ratio for both of its products, and while I think the actual figure is more in the neighborhood of 20 dB, the claim is not out of line. Tonna claims almost 37 dB F/B, and I find this hard to believe! But the 17-element yagi did exhibit 2 dB better than its nearest competitor, so I would have to assume—all things being equal—that it has the best F/B ratio of all three yagis. The 42-18 wins in the forward gain category by a slim margin, while no doubt at the greatest disadvantage in the tests.

To summarize:

Category	Winner
Gain	42-18 (.3 dB better)
F/B Ratio	F9FT (19.5 dB)
Sidelobe Rejection	42-18 (−43.3 dB)
Ease of Construction	F9FT
Quality of Construction	32-19/F9FT (A tie!)

And there you have it—not the most scientific test in the world, but one which probably approaches the conditions in the average amateur installation. (After all, who stacks their antennas 25 feet apart on the same mast?)

The Cushcraft 32-19 and 42-18 Boomers are available at most amateur dealers. The F9FT 17-element yagi is manufactured by Antennes Tonna of Reims, France and is available through the PX Shack. For more information, check the appropriate Reader Service number: Cushcraft 200, PX Shack 201.■

SCORE

by Perry Donham KW1O

MJC Technologies
3704-1/2 Foothill Blvd.
Suite 524
La Crescenta CA 91214
Price class: $100

Number 11 on your Feedback card

MJC's Sweepstakes Contest Operating Results Enhancer (SCORE) program is a contester's dream come true. SCORE is a complete tracking system for a single contest, the November ARRL Sweepstakes. The program dupes, logs, keeps score in real time, displays contest statistics, turns your Pro-Search rotor, and controls the station transceiver (currently only Heath's SS-9000 and Kenwood's TS-940 are supported).

The software runs on any IBM PC or compatible with at least one disk drive and 128K of RAM. Full color is supported if you have a color graphics adapter, but the system works and looks just fine in the monochrome mode.

Configuration

SCORE is an extremely flexible package. A series of preference screens let you set up the contest just the way you want it. Along with the expected call, exchange, section, and time information are places to choose band edges, antennas, USB or LSB, CW wide or narrow filters, display color and design, printer control sequences, and so on. With these screens you can create a unique contesting system specifically tailored to your operating habits.

The display is divided into two sections. The Control Panel, on the top of the screen, is where stations are logged and where the real-time statistics are kept. Time is automatically logged, as is the band and frequency (if you're computer-controlling a transceiver) of the contact. To the right of the log information is a box that shows your total contacts and sections, your score, and your total active and off time.

Below the Control Panel is a large area with a variety of functions. You can choose to display a running log book, transceiver and rotor information, or a list of sections worked/needed.

Contesting

I used SCORE for the CW section of the 1986 Sweeps. To see how user-oriented the program was, I decided not to look at the manual before the contest started. The menus and on-screen instructions were very clear and easy to follow, and I had no trouble setting all of the appropriate features to match my station. An on-screen context-sensitive help file is available if you get stuck; "context sensitive" means that the program keeps track of what you're trying to do and gives you help automatically on that topic.

Once the program was configured, I turned my attention to the contest (already in progress). Forty meters seemed open; since that was also the default band on the Control Panel, I quickly bagged about twenty QSOs. An immediate problem surfaced: SCORE uses a lookup table to help you enter the section (you only need to type enough letters to uniquely identify the section—WN for WNY is an example). The table unfortunately doesn't use two-letter postal abbreviations. Instead of typing AZ for Arizona, for example, you have to use ARI.

Frowning a bit from the abbreviation thing, I decided to move to 80 meters and work some of the fellows closer in. I quickly discovered that I couldn't change the band setting on the Control Panel. The only reference to the band in the manual was a brief blurb that told me I couldn't change the band manually while in transceiver-control mode. It turned out that the reverse tab key was the one to use, but it was just a fluke that I figured it out.

The rest of the system worked flawlessly, and I quickly got into a comfortable pattern of operating. The duping is very fast, and I ran along with the sections worked/needed report on the screen. It was a real treat to watch my score steadily climb, although I ended up watching it a bit too much.

Reports

Report generation is the icing on the SCORE cake. The program can spit out a variety of information, including the standard summary sheet and contest log. One of the more interesting reports is an operating profile, which depicts graphically what bands you worked and when, how many contacts were made on that band, and your QSO rate. This becomes useful when you start to plan next year's contest (you can see what you did this year and try something different!). The program keeps track of your on and off times, too, so you can immediately see how much time you need to wait before coming back on the air.

High SCORE

I give the SCORE package high marks. If you have the SS-9000 or the TS-940S, you will certainly appreciate the ability to control the rig right from the keyboard. As for making the switch to a computer for logging, I've operated this contest for many years and didn't miss my old paper dupe sheets one bit.

I should mention that the current release of SCORE, including a version in the works for the ARRL DX test, fixes the problem of bandswitching and also allows two-letter abbreviations.

For additional information about SCORE, please check Reader Service number 203.■

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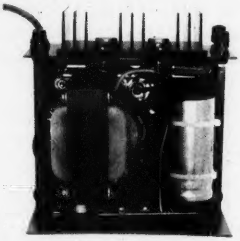

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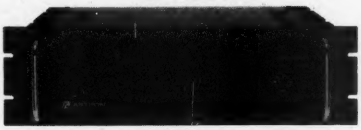

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RS-7A	5	7	3¾ x 6½ x 9	9
RS-7B	5	7	4 × 7½ × 10¾	10
RS-10A	7.5	10	4 x 7½ x 10¾	11
RS-12A	9	12	4½ x 8 x 9	13
RS-20A	16	20	5 x 9 x 10½	18
RS-35A	25	35	5 x 11 x 11	27
RS-50A	37	50	6 x 13¾ x 11	46

RS-M SERIES

MODEL RS-35M

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RS-12M	9	12	4½ x 8 x 9	13
RS-20M	16	20	5 x 9 x 10½	18
RS-35M	25	35	5 x 11 x 11	27
RS-50M	37	50	6 x 13¾ x 11	46

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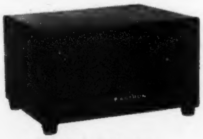
VS-35M	25	15	7	35	5 x 11 x 11	29
VS-50M	37	22	10	50	6 x 13¾ x 11	46

RS-S SERIES



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RS-10S	7.5	10	4 x 7½ x 10¾	12
RS-10L(For LTR)	7.5	10	4 × 9 × 13	13
RS-12S	9	12	4½ x 8 x 9	13
RS-20S	16	20	5 x 9 x 10½	18

Heil Ham Radio Handbook

by Chris Schmidt KA1MPL

Melco Publishing
PO Box 26
Marissa IL 62257
Price: $10.95 ppd.

Number 12 on your Feedback card

This is going to sound contrived, but I swear it isn't. As I was sitting at my desk trying to start this review, a co-worker, Phil (not a ham), came up to me and said: "Can I borrow that book that you left on your desk last night? Normally that ham radio stuff bores me to death, but that book is really interesting."

"That book" is the *Heil Ham Radio Handbook* and it is not like most other ham literature. Bob Heil K9EID treats ham radio as a fun pastime, not an exact science. A disclaimer to that effect is printed in the preface: "We present this handbook not as a literary masterpiece but as a practical guide for all to learn more about amateur radio and pray that perhaps each one of us will become a better operator because of it." The very fact that the *HHRH* makes no attempt to be comprehensive *allows* it to be fun reading. It is a reference book that doesn't read like one.

For the Newcomer

The *HHRH* assumes that the information you "learned" to pass your license test won't do you much good when it comes to the practical realities of getting on the air. Since the new licensee's first question is invariably, "OK, how do I get set up?" *HHRH* gives you clear instructions in plain (non-ham) language on what to do: selecting a station location, providing ac power and grounds, installing a feedthrough pipe in a wall, finding good used equipment, and selecting the best antenna for your available space. All ham lingo is explained when it appears, which prevents the newcomer from feeling like an outsider in his new hobby.

Operating Procedures

Chapter Three, "So You Want To Be A Lid," tells you exactly how to do so in no uncertain terms. Examples are taken from practices commonly heard on the air every day. K9EID is trying to clean things up a bit. He encourages you to take a quick listen on 27 MHz to hear the kind of operating habits we're moving towards. He also stresses that many hams acquire their lifelong operating habits on the local repeater, and he encourages new hams to hold themselves up to a higher standard.

Antennas

All the standard designs are explained and construction details are given for quite a few antennas—this is the most extensively covered topic in the book. K9EID takes great pains, though, to not take the fun out of what many consider to be the most interesting part of ham radio—fooling around with antenna construction: "The bottom line is, dive in and put some things together. If it works, super. If it doesn't, it's back to the drawing board and onto the tower."

Everything Else

In a similarly practical manner, the book covers remote bases, mobile operation, audio equalization (a K9EID specialty), a review of simple electronics, home-brewing tools and techniques (from soldering to building enclosures), grounding and RFI, and troubleshooting. It also includes 40 simple projects you can build.

In case you haven't figured it out, I think the *HHRH* is a great book. For a ham just starting out, I can think of no better tool to use—it is 168 pages of patient Elmering. But to imply that the *HHRH* is useful only for beginners is to do it a grave injustice. No matter how long you've been licensed, you'll find relevant and practical information—in plain English, not in engineerese—that will make you a better operator.

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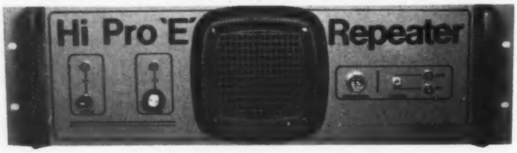

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UNITED STATES
PACIFIC
UNION OF SOVIET SOCIALIST REPUBLICS
INDIA
OCEAN
AUSTRALIA
73 Magazine's
DX Map of the World

One day not too long ago the staff of *73* was sitting at lunch over at The Folkway talking about DX and DXing and how crazy DXCC had gotten. The DXCC Honor Rollers have nothing left to work, and folks coming into the program have no hope of working countries that haven't been on the air for twenty years.

By the time we got around to coffee and mocha chip cake we had decided to start our own DX award. We wanted everybody to start with zero countries to liven things up a bit on the bands. Wayne suggested that we add to the ARRL's DXCC countries list by searching through the awards programs of IARU members. We decided to offer endorsements for every mode we could think of.

We want you to *have fun* with this award. The rules are simple, but the variety of levels and endorsements makes the award a challenge for both the beginner and the experienced DXer. We've come up with nearly 400 countries, so you'll not soon run out of things to work!

The Award

The basic award will be issued for 100 countries worked. Endorsements will be made for 150, 200, 250, 300, 350, 375, and 400 countries worked. The basic award is mixed-mode.

Special endorsements are available for single-band operation and for specific modes, including CW, SSB, satellite, Baudot RTTY, ASCII RTTY, AMTOR, packet, spread-spectrum, QRP (less than 5 Watts output), EME, FM, AM, FAX, and SSTV. Logs submitted for special endorsements must clearly indicate the band and mode used for all contacts.

The Rules

Effective Date: Only contacts made after 0001Z on January 1, 1987, will be eligible for the DXD Award.

Bands: Contacts may be made on any amateur band except 10 MHz. No cross-band contacts are allowed.

Modes: Any mode available to amateurs in your country may be used. Cross-mode contacts are allowed: The mode that *you* are using is what counts for the DXD Award.

Minimum report: There is no minimum signal report (you can't work 'em if you can't hear 'em).

Applications: QSL cards are not required for the DXD Award. Application must be made on an official DXD form, available from *73* Magazine—send an SASE to WGE Center, Peterborough NH 03458, Attn: DXDA. On the form, list your contacts in callsign order, indicating date, time, frequency or band, mode, and power. We may, on occasion, ask to see your log, so no funny business.

Fees: The fee for the basic award, due upon application, is U.S.$6. IRCs are not accepted. Each additional endorsement is U.S.$2. *Note: Endorsements requested on your first application are free.*

Country Criteria: Countries on the DXD Award list are taken from the awards programs of IARU member nations. If you come across a country not on the list that you feel should be included, send a copy of award rules from an IARU member which lists that country as being valid for an award to *73* Magazine for evaluation. New countries will be added as needed and announced in *73*.

Countries List: The DXD Award countries list will be printed from time to time in *73*. A copy of the current list (just under 400 countries, but still climbing) and an official application form are available from *73* Magazine, WGE Center, Peterborough NH 03458, Attn: DXDA.

Ready, Set...

Who will be the holder of DXDA #1? Who will be the first to hit the 300 country mark? Everyone has an equal shot at it, starting January 1st. We'll publish a list of DXD Award holders every month so that you can see how you are doing.

Excuse me, I see that it's 0001Z... CQ DX, CQ DX, CQ DX... ■

To receive a copy of the current DX Dynasty Award countries list and an official application form, send an SASE to *73* Magazine, WGE Center, Peterborough NH 03458, Attn: DXDA. *73*'s DX Map of the World is available for $5 ppd.

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A Power Supply Primer: Part II

Filtering the rectifier output.

Number 1 on your Feedback card

In Part I of this series (November, 1986) we discussed transformers and rectifiers. You learned that the transformer has a primary VA rating, which you should not underrate when you design electronic projects. You also learned that there are two basic forms of rectifiers, half-wave and full-wave, with the full-wave being preferred for almost all applications. There are two types of full-wave rectifiers: regular (which require two diodes and a center-tapped transformer) and bridge (which require four diodes, but no center-tap on the transformer). The center-tapped transformer will deliver twice the voltage when used with a bridge rectifier instead of with a two-diode regular circuit, but only half the current. The peak-inverse-voltage (piv) rating of the diode must be not less than 2.83 times the applied rms voltage, with most designers preferring 3 to 4 times as the minimum.

This month, I will discuss filtering of the pulsating dc output from the rectifier. But first, let's review the differences between the full-wave and half-wave rectified dc output.

Alternating current is *bi-directional*. That is, the current flows in one direction for a half cycle, and then it reverses direction and flows in the opposite direction for a period of time. In a perfect sinusoidal ac, the peak voltage in each direction is the same (even though polarity is opposite), and each half cycle occupies exactly the same amount of time. In 60-Hz ac systems, the period of the ac waveform is 1/60 second, or 16.67 milliseconds—each half cycle takes 8.34 milliseconds.

The output of a rectifier is *unidirectional*. That is, current flows in only one direction—like true dc. But this output is not pure, true dc, as can be seen in Fig. 1. The output of a half-wave rectifier is shown in Fig. 1(a). Only one-half of the ac waveform is used, so there are half-cycle gaps in the output voltage that represent the time required for the negative half cycle. The full-wave rectifier is more efficient and uses both halves of the ac cycle—Fig. 1(b). Note the difference in fre-

Program Listing 1.

```
100  REM  The name of this program is BRUTEFIL.
110  REM  This program will calculate either the ripple factor
120  REM  of a known power supply filter, or, the capacitance
130  REM  required to achieve a specified ripple factor.
140 GOSUB 1330
150 PRINT "This program will compute either the capacitance"
160 PRINT "needed to achieve a given power supply ripple factor,"
170 PRINT "or, the ripple factor of an existing power supply.
180 PRINT "The type of power supply for which this program is"
190 PRINT "designed is the BRUTE FORCE type in which a single"
200 PRINT "large value filter capacitor is connected in parallel"
210 PRINT "with the load."
220 PRINT
230 PRINT
240 GOSUB 1370
250 GOSUB 1330
260 PRINT "Select type of calculation to be performed:"
270 PRINT
280 PRINT "1.  Ripple factor of a given power supply"
290 PRINT
300 PRINT "2.  Capacitance needed to achieve a specified"
310 PRINT "    ripple factor (r)"
320 PRINT
330 PRINT "3.  Input voltage to produce required output voltage"
340 PRINT
350 INPUT "Choice Please:",A
360 IF A > 3, THEN GOTO 260
370 ON A GOTO 380,670,950
380 GOSUB 1330
390 PRINT "Now, let's collect some information -- OK?"
400 PRINT
410 INPUT "Output Voltage at Full Load?",VO
420 PRINT
430 INPUT "Maximum load current (Amperes)?",I
440 PRINT
450 INPUT "Value of Filter Capacitor C1 in uF?",C1
460 PRINT
470 C = C1/(10^6)
480 RL = VO/I
490 RFH = 1/(208*RL*C)
500 RFH = RFH*100
510 RFH = INT(RFH)
520 RFH = RFH/100
530 RFF = 1/(416*RL*C)
540 RFF = RFF*100
550 RFF = INT(RFF)
560 RFF = RFF/100
570 GOSUB 1290
580 PRINT "Fullwave Ripple Factor:";RFF
590 PRINT
600 PRINT "Halfwave Ripple Factor:";RFH
610 PRINT
620 GOSUB 1370
630 GOSUB 1400
640 IF S = 1, THEN GOTO 380
650 IF S = 2, THEN GOTO 250
660 IF S = 3, THEN GOTO 1500
```

Listing 1 continued.

```
670 GOSUB 1330
680 PRINT "Let's collect information, OK?"
690 PRINT
700 INPUT "Output Voltage at Full Load?",VO
710 PRINT
720 INPUT "Maximum load current (Amperes)?",I
730 PRINT
740 RL = VO/I
750 INPUT "Desired Ripple Factor?",RF
760 PRINT
770 C1H = 1/(208*RL*RF)
780 C1F = 1/(416*RL*RF)
790 GOSUB 1290
800 C1H = C1H*10^6
810 C1H = INT(C1H)
820 C1F = C1F*10^6
830 C1F = INT(C1F)
840 PRINT "To achieve a ripple factor of ";RF
850 PRINT "use a capacitor as follows:"
860 PRINT
870 PRINT "Fullwave circuit:";C1F;" uF"
880 PRINT "Halfwave circuit:";C1H;" uF"
890 PRINT
900 GOSUB 1370
910 GOSUB 1400
920 IF S = 1, THEN GOTO 670
930 IF S = 2, THEN GOTO 250
940 IF S = 3, THEN GOTO 1500
950 GOSUB 1330
960 PRINT "Now let's collect some information"
970 PRINT
980 INPUT "Required Output Voltage Under Load? ",VO
990 PRINT
1000 INPUT "Maximum load current (Amperes)? ",I
1010 PRINT
1020 INPUT "Filter capacitance being used (uF)? ",C
1030 PRINT
1040 C1 = C/10^6
1050 VPH = VO + (I/(240*C1))
1060 VPH = INT(VPH)
1070 VPF = VO + (1/(120*C1))
1080 VPF = INT(VPF)
1090 PRF = ((VPF-VO)*100)/VPF
1100 PRF = INT(PRF)
1110 PRH = ((VPH-VO)*100)/VPH
1120 PRH = INT(PRH)
1130 GOSUB 1290
1140 PRINT "Required Peak Pulsating DC Voltage:"
1150 PRINT
1160 PRINT "Halfwave case:";VPH
1170 PRINT "Fullwave case:";VPF
1180 PRINT
1190 PRINT "Voltage Regulation:"
1200 PRINT
1210 PRINT "Halfwave:";PRH;" %"
1220 PRINT "Fullwave:";PRF;" %"
1230 PRINT
1240 GOSUB 1370
1250 GOSUB 1400
1260 IF S = 1, THEN GOTO 950
1270 IF S = 2, THEN GOTO 250
1280 IF S = 3, THEN GOTO 1500
1290 FOR I = 1 TO 5
1300 PRINT
1310 NEXT I
1320 RETURN
1330 FOR I = 1 TO 20
1340 PRINT
1350 NEXT I
1360 RETURN
1370 PRINT "PRESS ANY KEY TO CONTINUE:"
1380 A$=INKEY$: IF A$="" THEN 1380
1390 RETURN
1400 GOSUB 1290
1410 PRINT "What's Your Pleasure?"
1420 PRINT
1430 PRINT "1.  Do Another of the same sort"
1440 PRINT "2.  Return to main menu to make another selection"
1450 PRINT "3.  Finished"
1460 PRINT
1470 INPUT "SELECTION?",S
1480 IF S > 3, THEN GOTO 1400
1490 RETURN
1500 GOSUB 1290
1510 PRINT "PROGRAM ENDED"
1520 END
```

quency between these two waveforms: The half-wave ripple frequency is the same as the applied ac frequency (e.g., 60 Hz in the U.S.), while the full-wave ripple frequency is twice the ac line frequency (120 Hz in 60-Hz systems). Because of the difference in efficiency, the transformer used to supply a half-wave rectifier must have a primary VA rating 40 percent higher than the transformer used in a full-wave circuit to supply exactly the same output voltage and current levels.

The word "ripple," bandied about as if everyone knows its meaning, indicates the departure from pure dc (which graphs to a flat line) exhibited by the rectified dc. On half-wave rectifiers, the ripple is around 120 percent, while on full-wave circuits it is around 48 percent. Unfortunately, few electronic circuits can tolerate these levels of ripple. In the case of an audio amplifier, the output sound would contain a terrible hum, while the results in other circuit forms range from the annoying to the catastrophic. The purpose of filtering is to reduce the ripple to an acceptable level of annoyance.

In this article, I will simplify matters by assuming that all rectifiers are bridge rectifiers—because they are more easily drawn. But you may assume that the same principles apply equally well to other forms of full-wave rectifiers and (with different values of components) to half-wave rectifiers.

Brute Force Filtering

Perhaps the most common form of filter circuit is the so-called "brute force" filter of Fig. 2. In this circuit, a capacitor (the filter) is connected in parallel with the load (R_L) and the output of the rectifier. It is crude and forceful, but it works nicely.

Circuit action for filter capacitor C1 is shown in Fig. 3. This waveform is for a full-wave rectifier. In the circuit of Fig. 2 there are actually two sources of current for the load: the rectifier and the charge stored in

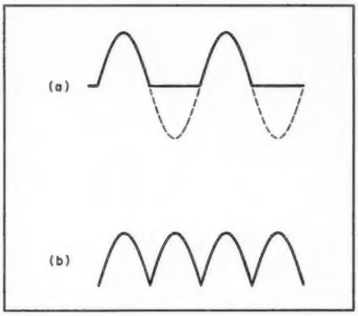


Fig. 1. (a) The output of a half-wave rectifier and (b) the output of a full-wave rectifier.

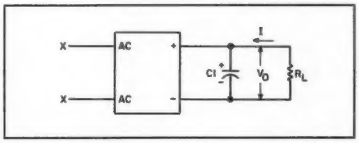


Fig. 2. Brute force filter.

capacitor C1. When the rectifier output voltage is higher than the capacitor voltage, the current in the load is supplied 100 percent from the rectifier. But, when the voltage from the rectifier passes its peak, current from C1 is dumped into the load to take up the slack. This is shown by the shaded areas in Fig. 3. The total energy in the load is thus higher. If you were to examine the waveform across the load when the filter capacitor is in the circuit, the waveform would resemble the heavy line in Fig. 3. The nearer this line is to a flat line, the nearer the dc output is to "pure" battery-style dc.

Half-wave rectifiers have larger spaces between the humps than full-wave circuits, so they must have a larger charge dumped by the capacitor. Because of this fact, the filter capacitors for half-wave circuits must be considerably larger than those for full-wave circuits to produce the same level of output ripple.

The output voltage is dependent on the value of the filter capacitor (see Fig. 3 for an intuitive grasp of this fact). Obviously, if less of the open space is filled in, the average voltage will be less. In one circuit that I built, a full-wave rectifier into a 150-milliampere load produced 13-V-dc output with no filter capacitor, 16.8-V-dc output with 200 uF, and 18-V-dc output when the filter capacitor was increased to 2000 uF. The peak voltage of the rectified waveform was 19 volts.

Ripple Factor

The ripple factor (RF) is the measure of the effectiveness of the filter in smoothing pulsating dc. For the single-capacitor brute force filter of Fig. 2, the ripple factor for a half-wave rectifier @ 60 Hz is $RF = 1/(208 \times R_L \times C1)$, and for a full-wave rectifier @ 60 Hz is $RF = 1/(416 \times R_L \times C1)$, where R_L is the load resistance in Ohms and C1 is the filter capacitance in Farads. (Note: The load resistance R_L is defined as the output voltage V_o divided by the output current I—in other words, $R_L = V_o/I$.)

Example

What is the ripple factor of a 15-V-dc full-wave power supply if 2000 uF is used for C1 in the filter circuit of Fig. 2 and the load resistance is 7 Ohms?

Solution: $RF = 1/(416 \times R_L \times C1)$

$RF = 1/(416 \times 7 \text{ Ohms} \times (2 \times 10^{-3} \text{ Farads}))$

$RF = 1/5.82$

$RF = 0.17$

In general, you don't need the version of the equation given above, but instead you want to select a filter capacitor for a specified value of ripple factor. For those cases, rewrite the equations in the following form: $C_{uF} = 10^6/(416 \times R_L \times RF)$, where C_{uF} is the capacitance of C1 in *microfarads* and all other terms are the same as defined above.

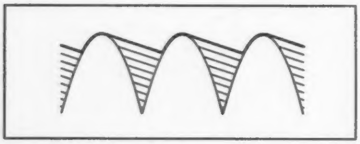


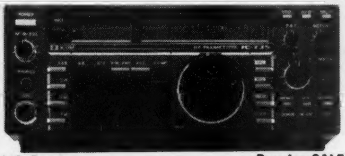
Fig. 3. Circuit action for filter capacitor C1.

The output voltage from this circuit for a half-wave rectifier @ 60 Hz is expressed by $V_o = V_p - (I/(120 \times C1))$, and for the full-wave rectifier @ 60 Hz is expressed by $V_o = V_p - (I/(240 \times C1))$, where all voltages are in volts, I is in Amperes, and C1 is in Farads.

Program listing 1 is a Basic program that

Program Listing 2.

```
100  REM  The name of this program is RCFILTER.PS
110  REM  This program computes the values required for resistor
120  REM  and capacitor elements in an RC filter network in a DC
130  REM  power supply circuit.
140 GOSUB 830
150 PRINT "This program is used to select values for an"
160 PRINT "RC power supply filter circuit."  YOU WILL NEED"
170 PRINT "to select the output voltages (V1 and V2) and currents"
180 PRINT "(I1 and I2), in addition to the desired ripple factors"
190 PRINT "for the two voltage outputs."
200 PRINT "In General, the ripple for the lower voltage output (V2)"
210 PRINT "is considerably lower than for the higher voltage output.
220 GOSUB 790
230 GOSUB 870
240 GOSUB 830
250 INPUT "Higher voltage output (V1)?",V1
260 PRINT
270 INPUT "Output current (in Amperes) for V1?",I1
280 PRINT
290 INPUT "Ripple factor required of V1?",RF1
300 PRINT
310 INPUT "Lower voltage output (V2)?",V2
320 PRINT
330 INPUT "Output current (in Amperes) for V2?",I2
340 PRINT
350 INPUT "Ripple factor required for V1?",RF2
360 GOSUB 830
370 RL1 = V1/I1
380 RL2 = V2/I2
390 C1 = 1/(416*RL1*RF1)
400 R1 = ((V2-V1)/I2) + (1/(120*C1))
410 R1 = -R1
420 C2 = (2*10^-6)/(C1*R1*RL2*RF2)
430 C1 = C1*10^6
440 C2 = C2*10^6
450 C1 = INT(C1)
460 C2 = INT(C2)
470 R1 = INT(R1)
480 PRINT "Capacitances given below are MINIMUM values"
490 PRINT "Select a Working Voltage DC (WVDC) rating that is"
500 PRINT "150-percent of the output voltage, or MORE"
510 PRINT
520 PRINT "*******************************"
530 PRINT "MAIN OUTPUT (V1):";V1;" Volts"
540 PRINT "MAIN OUTPUT CURRENT (I1):";I1;" Amperes"
550 PRINT
560 PRINT "Filter capacitor C1:";C1;" uF"
570 PRINT "Ripple Factor:";RF1
580 PRINT "*******************************"
590 PRINT "LOWER VOLTAGE OUTPUT (V2):";V2;" Volts"
600 PRINT "LOWER OUTFUT CURRENT (I2)";I2;" Amperes"
610 PRINT
620 PRINT "Filter Capacitor C2:";C2;" uF"
630 PRINT "Series Resistor (R1)";R1;" Ohms"
640 PRINT "Ripple Factor:";RF2
650 PRINT "********************************
660 PRINT
670 PRINT
680 GOSUB 870
690 GOSUB 830
700 PRINT "Select one (1) from menu below:"
710 PRINT
720 PRINT "1.  Do another"
730 PRINT "2.  Finished"
740 PRINT
750 INPUT "SELECTION?",K
760 IF K > 2, THEN GOTO 710
770 ON K GOTO 100,900
780 END
790 FOR I = 1 TO 5
800 PRINT
810 NEXT I
820 RETURN
830 FOR I = 1 TO 30
840 PRINT
850 NEXT I
860 RETURN
870 PRINT "PRESS ANY KEY TO CONTINUE"
880 A$=INKEY$: IF A$="" THEN 880
890 RETURN
900 GOSUB 830
910 PRINT "PROGRAMED ENDED"
920 END
```



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IC-751 9-band xcvr/.1-30 MHz rcvr	1399.00	999^{00}
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FL-32 500 Hz CW filter (1st IF)	66.50	
FL-63 250 Hz CW filter (1st IF)	54.50	
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SP-3 External speaker	61.00	
SP-7 Small external speaker	49.00	
CR-64 High stab. ref. xtal (745/751)	63.00	
PP-1 Speaker/patch..................	159.25	149^{95}
SM-6 Desk microphone	44.95	
SM-8 Desk mic - two cables, Scan.....	78.50	
SM-10 Compressor/graph EQ, 8 pin mic	136.25	124^{95}
AT-100 100W 8-band auto. antenna tuner	445.00	389^{95}
AT-500 500W 9-band auto. antenna tuner	559.00	489^{95}
OPC-118 Adapts AT-100/500 to IC-735	16.00	
AH-2 8-band tuner w/mount & whip	625.00	549^{95}
AH-2A Antenna tuner system, only....	495.00	429^{95}
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IC-271H 100W 2m FM/SSB/CW......	1099.00	969^{95}
AG-25 Mast mounted preamplifier...	95.00	
IC-471A 25W 430-450 SSB/CW/FM xcvr	979.00	869^{95}
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IC-471H 75W 430-450 SSB/CW/FM	1399.00	1169
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PS-25 Internal power supply for (A)...	115.00	104^{95}
PS-35 Internal power supply for (H)...	199.00	179^{95}
SM-6 Desk microphone	44.95	
EX-310 Voice synthesizer	46.00	
TS-32 CommSpec encode/decoder....	59.95	
UT-15 Encoder/decoder interface...	14.00	
UT-15S UT-15S w/TS-32 installed.....	92.00	

VHF/UHF mobile multi-modes	Regular	SALE
IC-290H 25W 2m SSB/FM, TTP mic...	639.00	569^{95}
IC-490A 10W 430-440 SSB/FM/CW	699.00	599^{95}

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IC-27A Compact 25W 2m FM w/TTP mic	429.00	379^{95}
IC-27H Compact 45W 2m FM w/TTP mic	459.00	399^{95}
IC-37A Compact 25W 220 FM, TTP mic	499.00	439^{95}
IC-47A Compact 25W 440 FM, TTP mic	549.00	489^{95}
PS-45 Compact 8A power supply ...	139.00	129^{95}
UT-16/EX-388 Voice synthesizer ...	34.99	
SP-10 Slim-line external speaker ...	35.99	
IC-28A 25W 2m FM, UP/DN mic......	429.00	379^{95}
IC-28H 45W 2m FM, UP/DN mic......	459.00	399^{95}
IC-38A 25W 220 FM.................	459.00	399^{95}
IC-48A 25W 440-450 FM	459.00	399^{95}
HM-14 TTP microphone	55.50	
UT-28 Digital code squelch.........	37.50	
UT-29 Tone squelch decoder	43.00	
HM-16 Speaker/microphone	34.00	
IC-3200A 25W 2m/440 FM w/TTP....	599.00	499^{95}
UT-23 Voice synthesizer............	34.99	
AH-32 2m/440 Dual Band antenna ...	37.00	
AHB-32 Trunk-lip mount	34.00	
Larsen PO-K Roof mount...........	20.00	
Larsen PO-TLM Trunk-lip mount....	20.18	
Larsen PO-MM Magnetic mount	19.63	
RP-3010 440 MHz, 10W FM, xtal cont.	1229.00	1099
IC-120 1W 1.2 GHz FM Mobile........	579.00	499^{95}
ML-12 1.2 GHz 10W amplifier	379.00	339^{95}
IC-1271A 10W 1.2 GHz SSB/CW Base	1229.00	1079
AG-1200 Mast mounted preamplifier	105.00	
PS-25 Internal power supply	115.00	104^{95}
EX-310 Voice synthesizer...........	46.00	
TV-1200 ATV interface unit.........	129.00	119^{95}
UT-15S CTCSS encoder/decoder ...	92.00	
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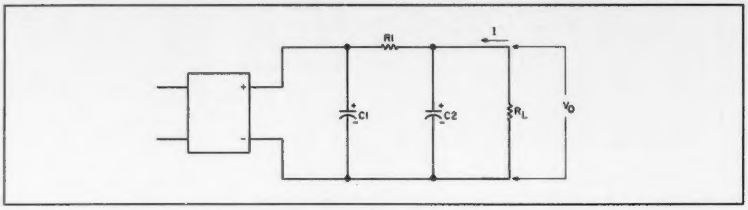

Fig. 4. Pi-section filter.

will calculate (a) the ripple factor of a given power supply, (b) the capacitance required to achieve a specified ripple factor, and (c) the input voltage required from the rectifier to produce a specified output voltage.

Pi-Section Filters

One disadvantage of the brute force filter is that tremendous values are needed to achieve very low ripple-factor figures. If you cascade a simple RC filter with the brute force filter of Fig. 2, you have the pi-section filter of Fig. 4. The ripple factor of V_o is very small, but there is a limit to the output current due to the presence of resistor R1. Also, voltage regulation suffers a little bit when the load current varies widely. The ripple factor for this type of filter for the half-wave rectifier @ 60 Hz is $RF = 10^{-5}/(C1 \times C2 \times R1 \times R_L)$, and for the full-wave rectifier @ 60 Hz is $RF = 2 \times 10^{-6}/(C1 \times C2 \times R1 \times R_L)$, where all capacitances are in Farads and resistances are in Ohms.

Program listing 2 is a Basic program to design RC pi-section filter circuits. This program actually combines two designs, because it assumes that the voltage across C1 is one of the outputs of the power supply, while the voltage across C2 is the other output.

Bleeder Resistors

It is generally good practice to provide a bleeder resistor across the output of a dc power supply. The resistor tends to stabilize the load and, in high-voltage supplies, provide a safety feature against electrocution when you are servicing dc supplies. The bleeder resistor gets its name from the fact that it tends to "bleed off" the potentially lethal charge stored on the filter capacitors. A common specification for high-voltage power supplies is to make the bleeder current equal to five percent of the rated output current. For a 1000-milliampere dc power supply, therefore, the bleeder should be 50 mA (0.050 Amperes). The value of the bleeder should be approximately $R = V/(0.05 \times I_o)$—in the case above the supply produced 700 volts dc; the value should be $R = 700/0.050$, or 14,000 Ohms.

The power rating is defined by $P = IR$, or, in the example above, it should be $0.05 \text{ A} \times 700 \text{ V} = 35$ Watts (use a 50-Watt or higher resistor).

Even low-voltage power supplies should have a bleeder resistor in some cases. In high-current, unregulated power supplies, an unloaded output can produce a voltage that is too high for the filter capacitor. In the S-100 computer power supply, which produces +8 V dc at 5 to 30 Amperes (depending on the system configuration), the typical filter capacitor is rated at 15 WV dc. In one 10-Ampere version that I built, disconnecting the computer motherboard produced +18 volts across the filter capacitor—a dangerous level. A 100-Ohm, 5-Watt bleeder solved the problem.

Filter Capacitor Voltage Ratings

I once repaired medical equipment for a living. There was one bedside oscilloscope in our hospital that used a 200-volt regulated power supply in which the pre-regulator voltage (i.e., across the filter capacitor at the output of the rectifier) was 270 V dc. The filter capacitors were rated at 60 uF @ 350 WV dc, seemingly sufficient. But those capacitors had an exceedingly high failure rate. Out of 12 scopes, at least one would fail every month. The capacitors were swollen, and that often indicates an overvoltage condition.

Let's look at the arithmetic, with normal tolerances considered. The line voltage will vary ±15 percent, so the worst-case voltage will be 1.15 V, or $1.15 \times 270 = 311$ volts. The normal rule of thumb for capacitor ratings (unless the manufacturer claims otherwise) is ±20 percent. Thus, our 350-WV-dc filter capacitor could be in truth a lower voltage device: WV dc (real) = 0.80 WV dc = $0.8 \times 350 = 280$ volts. Under worst-case conditions, then, that errant scope had placed 311 volts across a 280-volt capacitor! Replacing the 60-uF @ 350-WV-dc capacitor with a 60-uF @ 450-WV-dc unit kept me in bed at night—and those nurses had more confidence in both the scopes and their biomedical engineers!

When selecting filter capacitors, then, try to pick one that has a WV-dc rating of 150 percent or more of the required minimum value. If possible, go even higher.

The usual rule of thumb for capacitance in aluminum electrolytic capacitors—the kind normally used in filter circuits—is that the actual capacitance will be −20 to +100 percent of the rated capacitance. Thus, a 1000-uF capacitor will measure 800 to 2000 uF. Keep these figures in mind when selecting a filter capacitor.

Next Time

In the next installment of this series, I will look at voltage regulator circuits including zener diodes, three-terminal IC regulators, adjustable IC regulators, and non-IC regulators. ■

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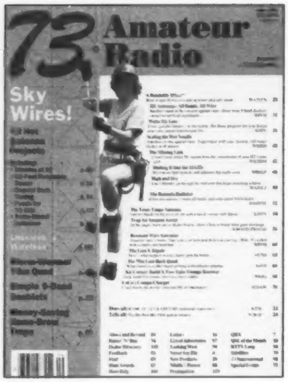

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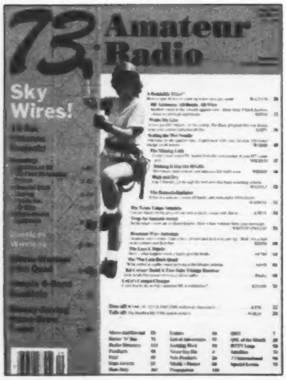

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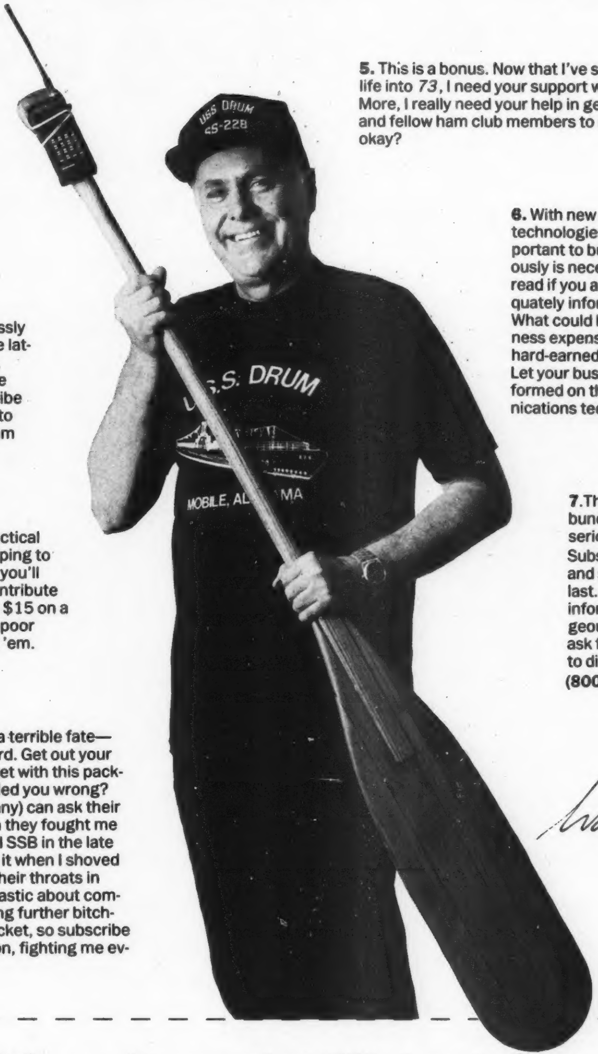

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That brings us to the purpose of this article: to describe a circuit for less than $35 that will turn on transmitters, shut off lights, or run our personal computers.

Our circuit is constructed around the Silicon Systems CMOS chip SSI 202 P. (There are several other alternative devices, namely the GTE G8860X, Teletone M-947, etc., but they are not pin-compatible and may have additional features.) The obvious advantage of this device is its simplicity and the reduction of our work. Instead of wiring up a rather large piece of real estate to decode DTMF signals, we can now do the same thing using one 18-pin IC.

Some of the other advantages are: (1) low power consumption, (2) a 5-volt supply, (3) use of a cheap color-TV crystal for frequency reference, and (4) a tri-state output for ease of interfacing to a computer bus.

The circuit that I will describe is a compromise between two modes of reception—the phone and the radio. The circuit is deliberately left open-ended for modification for one's own use.

To start off, one has to bring a +5-volt supply to the card (pin 5). Next, connect the signal input (pin 9); the preferred way to do this is through a .01-uF capacitor. You can omit this input capacitor only if the input voltage is always lower than 5 volts.

The 3.579-MHz crystal, along with a 1-meg, 10% resistor, is installed across pins 11 and 12. The oscillator is enabled by tying pin 8 high. When pin 2 is tied high, the output is hex; when low, it is a binary-coded 2 of 8.

Pin 4 inhibits tone pairs with the 1633-Hz component. Since telephones don't use this band, I tied it high to inhibit it. Pin 3 high enables outputs D1, D2, D3, and D4; when low, the outputs are high impedance.

There is a provision on the board to install 100k resistors to supply or ground to establish a preset on the bus. This would provide an output from the auxiliary chips when the decoder is in a high-impedance mode.

When a tone pair is decoded, pin 14 will go high for approximately 30 milliseconds (or less if reset by pin 15 going high). Our bus output is tied to a 74C42 binary-to-decimal decoder. This will decode each of our touchtone inputs to nine individual output lines. This could easily have been a 4-to-16 driver, but in the interest of cost and size, it was decided to go with nine out. (Due to the touchtone limitation of 12 keys, 16 lines out would be a slight overkill; it also comes in a 24-pin chip, which will use up more space on the board.)

The output of the decimal decoder is then sent to individual JK flip-flops. A provision is installed to allow one digit to be attached from the decimal decoder to the master reset line to all of the flip-flops.

Once reset, a detected dual tone will cause the following series of events to occur:

Pin 14 on the decoder chip will go high; this will in turn put a logic 1 on all of the J and K inputs, and at the same time an enable command is sent to pin 3 of the decoder chip to allow the decoded tone to be put on the data bus. The binary number is decoded and the appropriate decimal output goes low. This high-to-low transition toggles the flip-flop and allows the Q output to change state.

After approximately 30 ms, pin 14 goes low and the data bus returns to its preset value (due to the pull-up or pull-down resistors).

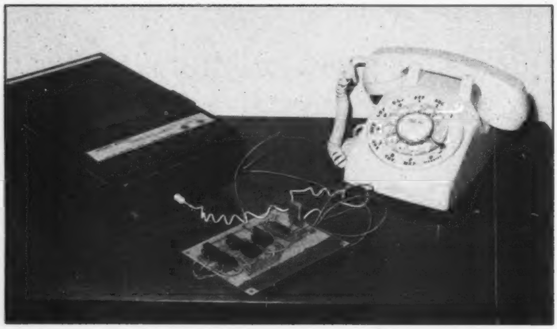


Photo A. The remote-control system, wired and waiting for a call.

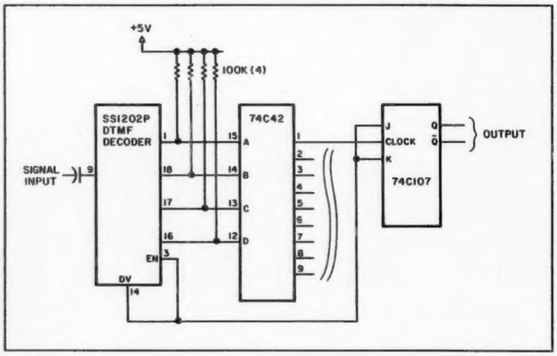


Fig. 1. Circuit concept.

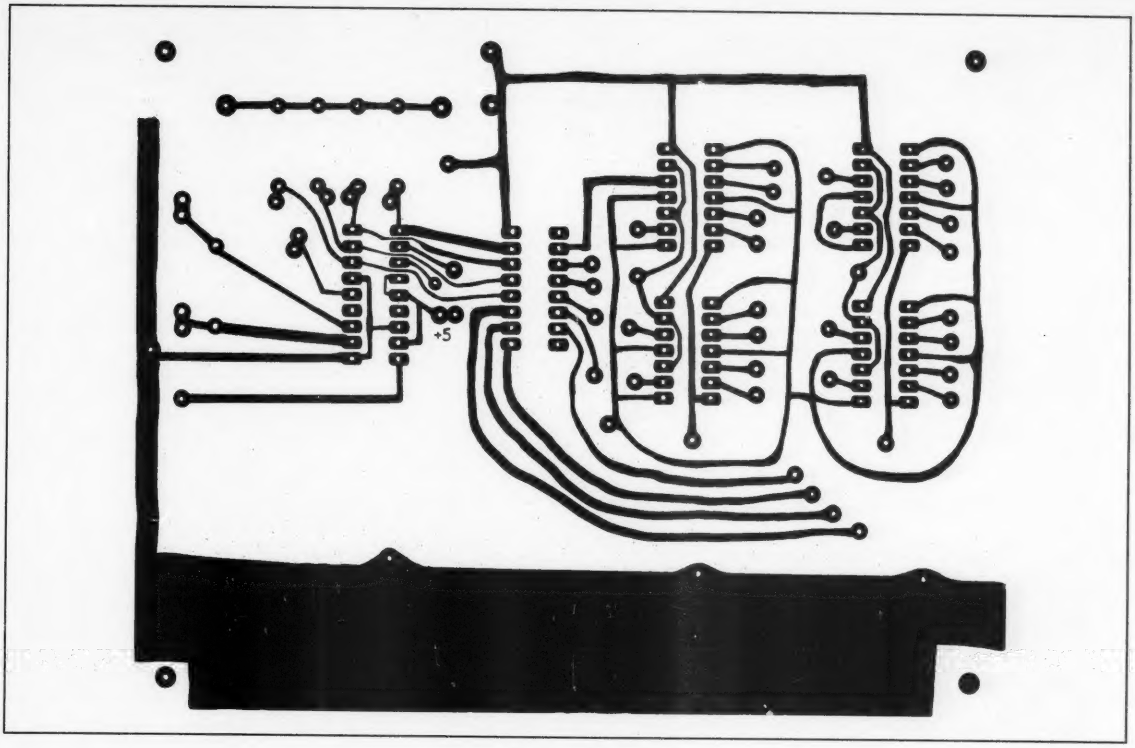
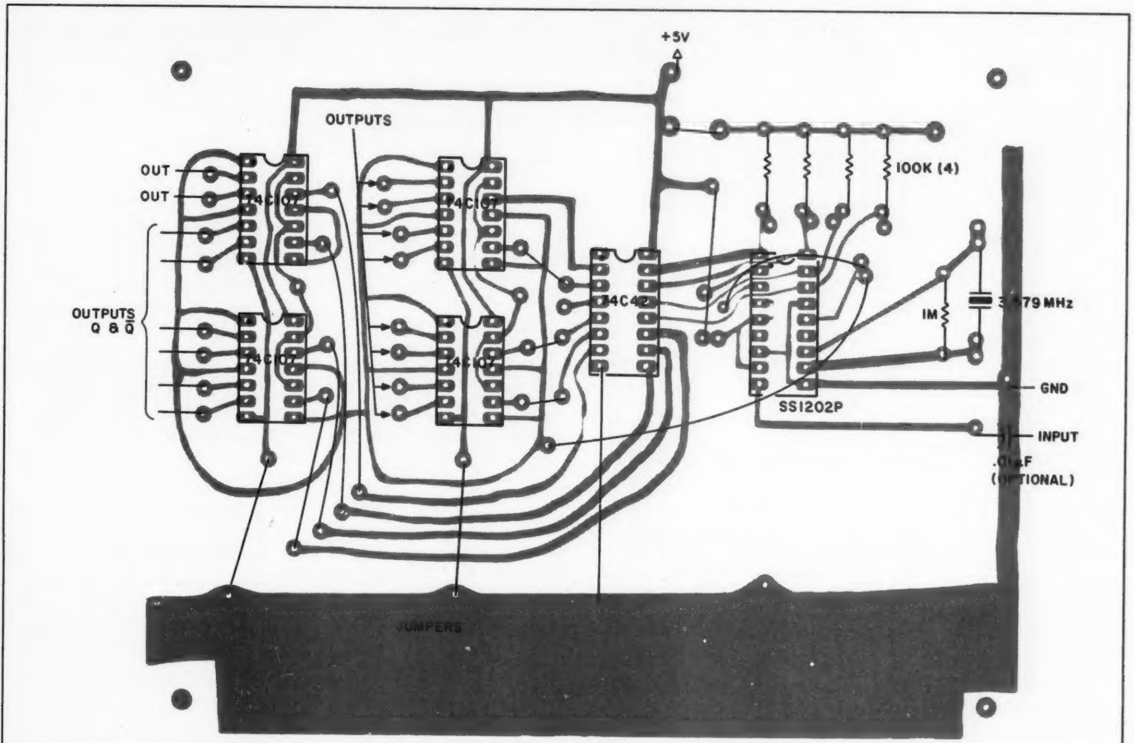


Fig. 2. Circuit board, foil side.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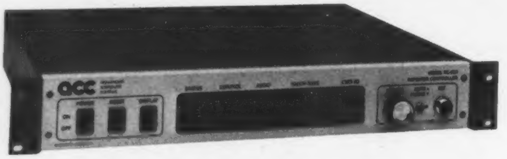
OUT
OUT
74C107
74C107
74C107
74C107
100K (4)
OUTPUTS Q & Q̄
74C42
IM
3.579 MHz
GND
SS1202P
INPUT
.01µF (OPTIONAL)
JUMPERS

Fig. 3. Circuit board, parts placement.

The decoder decodes the preset value on the bus and causes a corresponding transition on the output. Typically, the preset would be all zeros (binary 0) or all ones (binary 15). Various combinations could be used in tying to the bus allowing the preset to be used in configuring one's own personal code. The flip-flop that was toggled would still be at its transferred state and therefore could be used to turn on/off equipment.

This project was set up for phone use but could be modified for a radio-access code using a few simple parts (possibly including an LS7220 digital lock chip—under $3—to limit access to the equipment). The decoder was tied into a telephone-answering machine procured for $10 at a ham flea market. The output was connected to turn on and off lights and appliances.

Interfacing the equipment is rather simple, the input being the wire to the speaker or input to the tape recorder. The output from the 74C107 flip-flops is limited to 1.75 mA. Therefore, to drive a load more substantial than an optoisolator or a small LED, one would need either a small transistor or a buffer driver. I elected the transistor because of size, simplicity, and cost. I used a 5k resistor to limit the output to 1 mA and used a small switcher (such as a 2N3904, 2N3906, etc.). This can increase output current by an order of magnitude to run a relay. With the addition of some peripheral equipment to the relays, one should be ready to operate one's equipment remotely. ■



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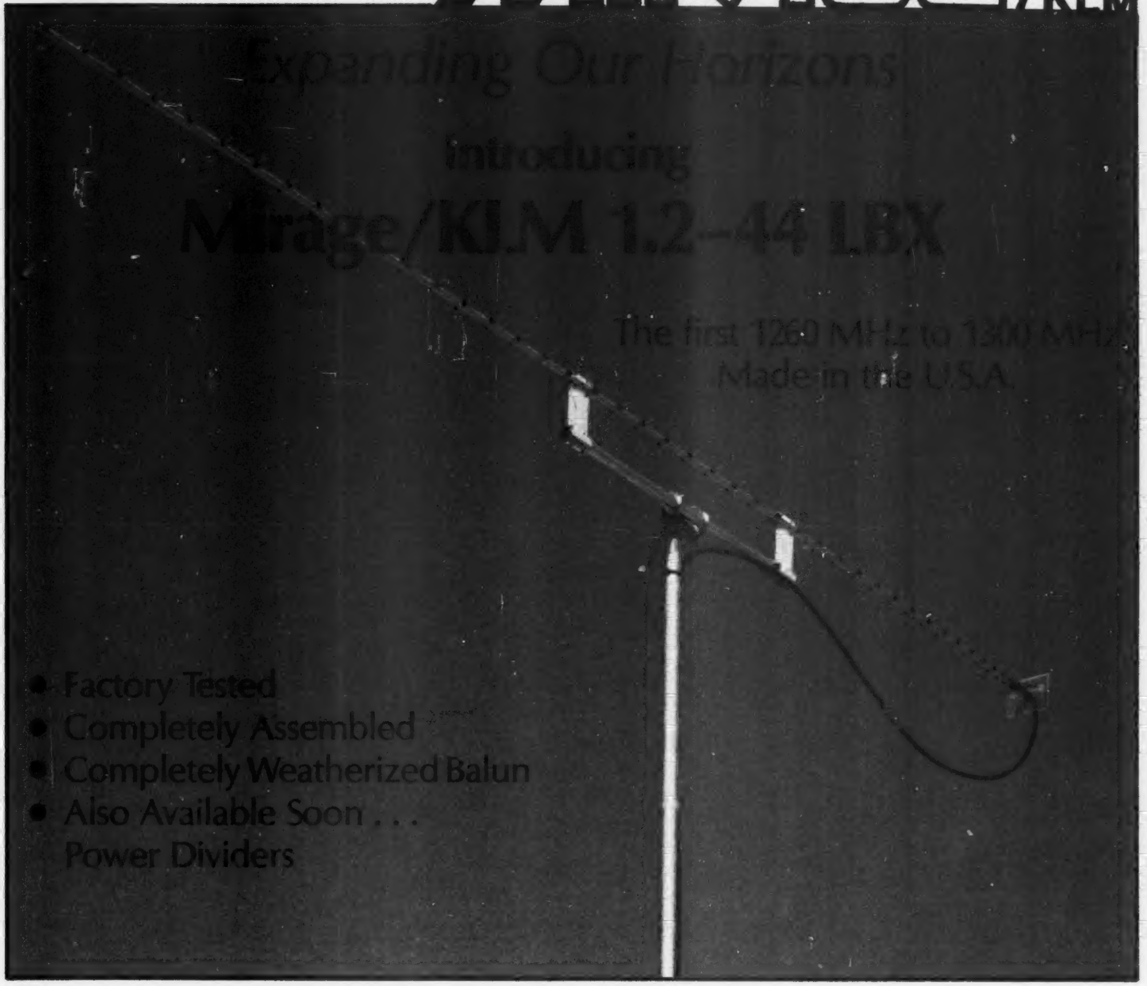

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The Glue Ribbon Solution

May the glue-bird of happiness drop some conductive graphite-epoxy mix right where you need it.

Number 3 on your Feedback card

Recently I had a problem in a power supply and traced it to a faulty ground connection. The chassis was aluminum, and this prevented soldering the ground terminal down. Being an inventor, I didn't let this stop me. I *glued* the ground terminal down.

Many times I have built circuits that were too tight for a heat sink or were too sensitive for easy soldering or had any of a number of other problems that made soldering undesirable. A frequent problem is the aluminum chassis we all know and love—but can't solder to. Another is the ubiquitous aluminum antenna element. In each case, a number of people have tried, usually in vain, to solve the problem of poor solder bonds.

I solved my problem with glue.

Many hams know of the silver dust that is used to make a special conductive cement. They also know that the price is out of reach of most of us. I decided to home-brew my own. For the glue base I used two-element epoxy. Instead of silver dust I used powdered graphite, which is available as "dry lock lubricant" and can be purchased anywhere—a discount house in Tulsa carries four brands.

It's common knowledge that this graphite can be mixed with petroleum jelly to make a conductive grease to lubricate bearings on air-dielectric variable capacitors (while maintaining the conductivity across the bearings). It is also used for hand keys on their little bearing points. A toothpick with a dab of this conductive grease on the end will make the key or cap work like a charm.

But my need was not for grease. I needed glue.

I tried to mix up the epoxy and stir in as much graphite as I could. Unfortunately, the carbon was a catalyst for the hardening process, and the stuff hardened before I could stir in enough graphite to have a usefully low resistance. Back to the drawing board (or glue pot, as the case may be) for further study.

Discovery

I took a two-ounce glass pill bottle and put in a half ounce of one component of the epoxy cement (the component that smells like a home permanent). Then I stirred in as much graphite as I could. It hardened immediately. I then tried stirring graphite into another bottle containing the other component of epoxy, which has a faint oily smell. It just sat there! The addition of a little thinner allowed it to take even more graphite. By having most of the graphite premixed into one of the epoxy components, I would gain enough time to use the glue before it set. I capped this mix and set it aside.

> ***"If you work quickly, the reaction will not go to completion while you're trying to get your resistance down to nil."***

When you have an application for the glue, put some of your premixed preparation on a card and add the proper amount of hardener (according to the instructions) and quickly add more graphite. If you work fast, the reaction will not go to completion while you're trying to get your resistance down to nil. You will *barely* have time to apply the cement where you need it.

This glue can be used to make resistors, too. If you need a high-Wattage, low-value resistor, dump a gob of glue between a couple of heavy spade terminals. This works fine with dc. I don't know how it will react to rf.

Caution

The stuff smears terribly. You will need some acetone to wash the glue off of things and a small, sharp pointed tool to clear any bridges from between adjacent circuits. Use the pointed tool after the epoxy sets, and use a toothpick or a cotton swap soaked in acetone to remove the final traces of conductive glue from unwanted places.

The cost? I paid 79¢ for a tube of graphite and $1.98 for the two-part epoxy cement. So far I've used about ten percent of the stuff, and have applied it to everything but the cat, which escaped. We may never have to burn the kitchen table again! ■

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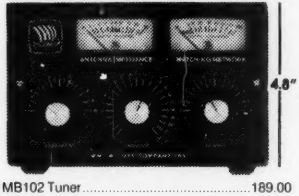

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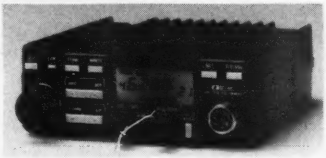

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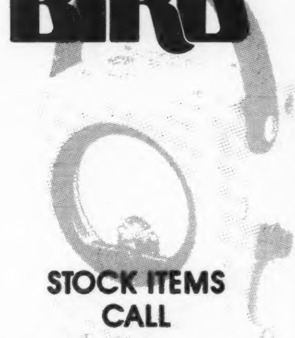

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100 watts	100H	100A	100B	100C	100D	100E
250 watts	250H	250A	250B	250C	250D	250E
500 watts	500H	500A	500B	500C	500D	500E
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2500 watts	2500H					
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What started life as a meek intrusion alarm winds up as a hot 10-GHz transceiver.

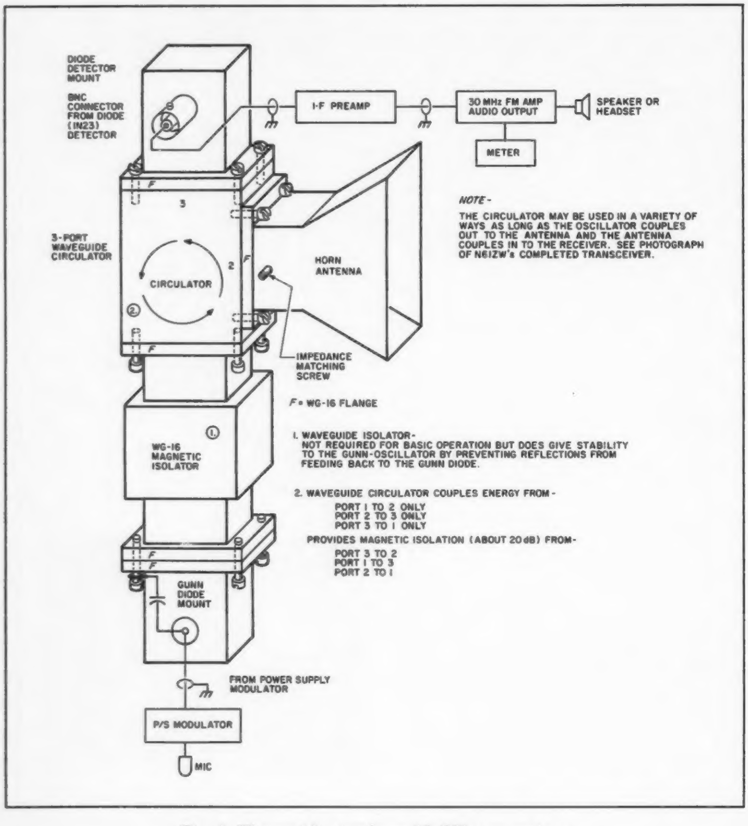
Number 4 on your Feedback card

It's not very hard to set up a station for 10 GHz. I have been experimenting with a portion of a Solfan Doppler-radar intrusion alarm that I converted for use at 10.250 GHz. These alarms can be found pretty easily at hamfests, and I have heard many people speak of the high availability of these units in Europe, where this type of alarm circuit is used extensively.

I have found two different types. Whatever unit you obtain can be used with the methods described here. The first unit that I'll describe is the Solfan Intrusion Alarm Gunn diode mount and detector assembly. This has both a Gunn diode and detector diode mounted in the same cast waveguide mount. The waveguide size is WG-16, or 0.4" high by 0.9" wide. It does not have varactor tuning for afc like the Microwave Associates Gunnplexer. The mount is about three inches long with the Gunn diode placed at the rear center of the cavity and coupled to the mixer diode by a small round waveguide iris midway between the two ends of the cavity.

The detector diode is mounted offset to one side of the forward waveguide cavity for low coupling. Both cavities have tuning screws for impedance matching and frequency adjustment. Photos A and B show the end and side views of the various Solfan units. Photo A shows the internal waveguide construction and where the diodes are mounted. Note that the Gunn diode is mounted dead center in the cavity, while the larger detector diode is mounted on the side of the cavity wall.

The second type of Solfan mount is a single Gunn diode transmitter-type unit. This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①
GUNN DIODE MOUNT
FROM POWER SUPPLY MODULATOR
P/S MODULATOR
MIC

NOTE -
THE CIRCULATOR MAY BE USED IN A VARIETY OF WAYS AS LONG AS THE OSCILLATOR COUPLES OUT TO THE ANTENNA AND THE ANTENNA COUPLES IN TO THE RECEIVER. SEE PHOTOGRAPH OF N6IZW's COMPLETED TRANSCEIVER.

F = WG-16 FLANGE

1. WAVEGUIDE ISOLATOR- NOT REQUIRED FOR BASIC OPERATION BUT DOES GIVE STABILITY TO THE GUNN-OSCILLATOR BY PREVENTING REFLECTIONS FROM FEEDING BACK TO THE GUNN DIODE.
2. WAVEGUIDE CIRCULATOR COUPLES ENERGY FROM -
   PORT 1 TO 2 ONLY
   PORT 2 TO 3 ONLY
   PORT 3 TO 1 ONLY
   PROVIDES MAGNETIC ISOLATION (ABOUT 20 dB) FROM-
   PORT 3 TO 2
   PORT 1 TO 3
   PORT 2 TO 1

Fig. 1. Waveguide circulator 10-GHz transceiver.

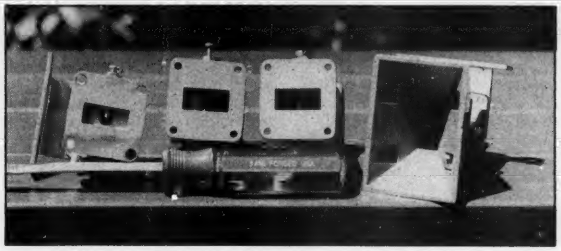


Photo A. Waveguide flange end showing from left to right: iris coupling from single Gunn mounts, detector diode on the side of the cavity, very small Gunn diode mounted in the cavity center, and another single Gunn mount with a small horn.

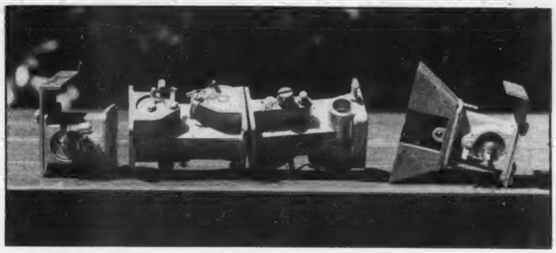


Photo B. Side view of the Solfan Gunn mounts. The ends are the single oscillator units. The center two units are the double mount (oscillator-detector assemblies). Various adjustments and connection terminals are visible.

device does not have a detector diode attached with its cavity. I don't know what the detector mount looks like, as I haven't run into one yet. I've used this mount as a single point source to test other transceivers and have mounted one unit into one port of a 3-port circulator, with a detector mount and an antenna tied to the third port. While sensitivity was slightly lower than on other models, it did perform quite well. See Fig. 1 for details on the circulator system.

> **"Operation during contest weekend may give some stations an edge of quite a few points by working a surprising number of different grid squares and contact points."**

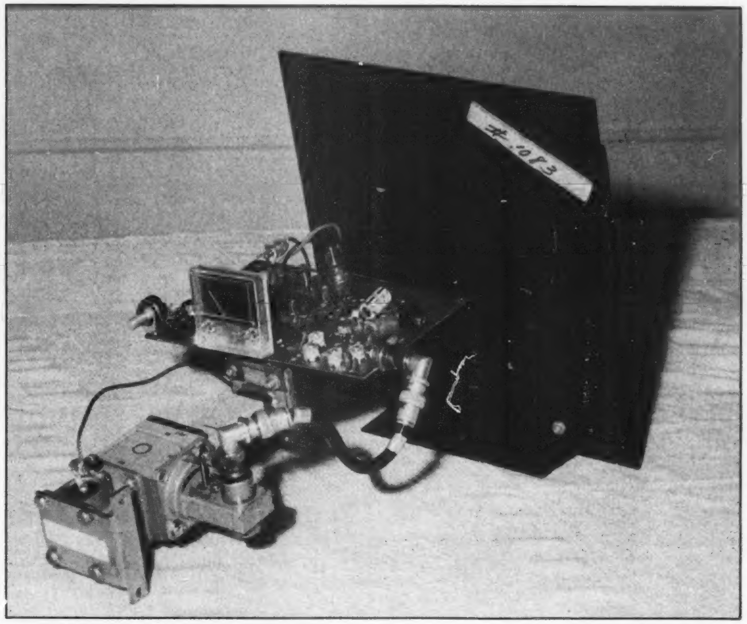


Photo C. 10-GHz transceiver (N6IZW) mounted on a large horn antenna. The system uses a single Solfan Gunn oscillator, circulator, diode detector, and the completed i-f amp, S-meter modulator circuit board.

There are many different configurations of detectors, waveguides, and oscillators that will produce a working station. What your finished product looks like depends on the materials you are able to scrounge up from junk boxes and swap meets. Photo C of N6IZW's completed transceiver using a circulator and detector mount coupled with PC boards described in this article shows how simple components can be assembled into a complete system package. Photo D depicts a minimum transceiver.

System Description

To be able to construct a full-duplex transceiver for 10 GHz, you need four basic components: a 30-MHz i-f amp, a power-supply modulator, an i-f preamp, and a Gunn diode waveguide cavity/detector diode assembly. If you can find one of these units at your local swap meet, it will make this project very easy to build. If you cannot obtain one of the units, a suitable oscillator mount and detector assembly may be constructed

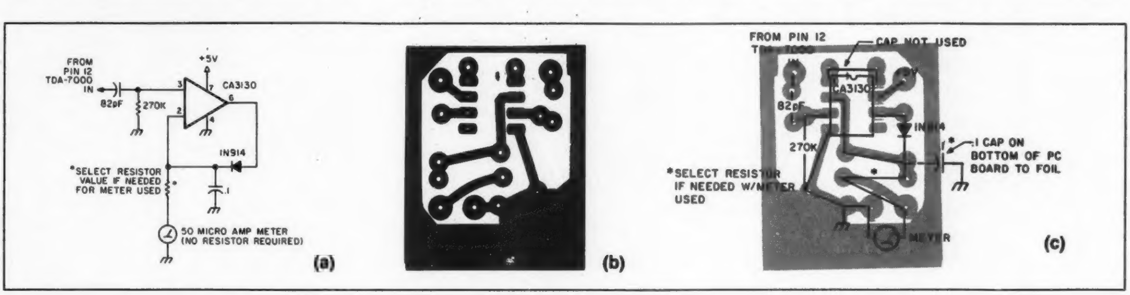

FROM PIN 12 TDA-7000 IN
+5V
CA3130
82pF
270K
3
7
6
2
4
IN914
*SELECT RESISTOR VALUE IF NEEDED FOR METER USED
.1
50 MICRO AMP METER (NO RESISTOR REQUIRED)
(a)
(b)
FROM PIN 12 TDA-7000 IN
CAP NOT USED
CA3130
+5V
82pF
IN914
270K
*SELECT RESISTOR IF NEEDED W/METER USED
.1 CAP ON BOTTOM OF PC BOARD TO FOIL
METER
(c)

Fig. 2. Signal-strength meter circuit (a) schematic, (b) circuit board, foil side, and (c) parts placement.

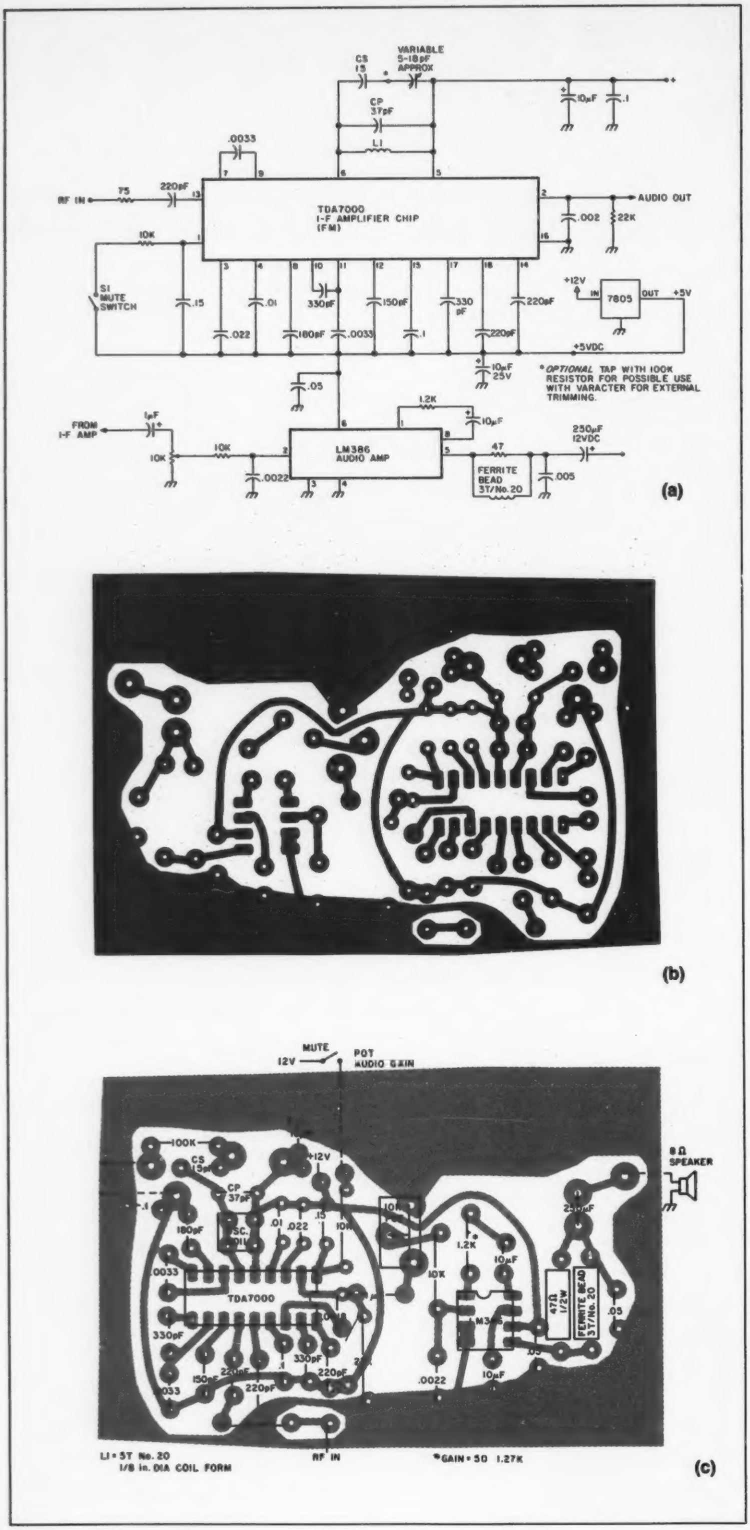

VARIABLE
5-18pF
APPROX
CS
15
CP
37pF
L1
10μF
.1
.0033
RF IN
75
220pF
TDA7000
I-F AMPLIFIER CHIP
(FM)
AUDIO OUT
.002
22K
10K
S1
MUTE
SWITCH
.15
.01
330pF
150pF
330
pF
220pF
+12V
IN
7805
OUT
+5V
.022
180pF
.0033
.1
220pF
+5VDC
10μF
25V
*OPTIONAL TAP WITH 100K RESISTOR FOR POSSIBLE USE WITH VARACTER FOR EXTERNAL TRIMMING.
.05
1.2K
10μF
FROM
I-F AMP
1μF
10K
10K
LM386
AUDIO AMP
.0022
47
250μF
12VDC
FERRITE
BEAD
3T/No. 20
.005
(a)
(b)
MUTE
12V
POT
AUDIO GAIN
100K
CS
15pF
+12V
CP
37pF
.1
180pF
OSC.
COIL
.01
.022
.15
10K
10K
1.2K
10μF
250μF
8 Ω
SPEAKER
.0033
TDA7000
330pF
LM386
47Ω
1/2W
FERRITE BEAD
3T/No. 20
.05
150pF
220pF
.1
330pF
220pF
22K
220pF
.0022
10μF
.05
.0033
L1 = 5T No. 20
1/8 in. DIA COIL FORM
RF IN
*GAIN = 50 1.27K
(c)

Fig. 3. 30-MHz FM receiver i-f amp (a) schematic, (b) circuit board, foil side, and (c) parts placement.

from a piece of scrap waveguide (WG-16), as described in the *RSGB VHF Handbook*, 4th edition, Chapter 9.43, Figure 99. Anyone should be able to construct the unit with simple tools.

Safety

One word of caution with microwave devices is that you should never look into the open end of a radiating waveguide, as serious eye damage can result. With low-power Gunn diodes, the safe distance is reached in a relatively short space—say several feet—but you should still never look into one.

I-f Amplifier

The i-f amplifier that I used was first published in the October, 1986, issue of *73*. This single-chip, 30-MHz i-f amplifier with its audio output stage occupies one small PC board. The design of the i-f amplifier was modified to provide a signal-strength tuning indicator, which ties to pin 12 on the TDA7000 with an 82-pF coupling capacitor. The addition of this CA3130 op amp greatly improved the system, allowing an indication of signal strength for antenna direction and an evaluation of system performance.

The modification was made by Kerry Banke N6IZW, who mounted the circuit dead-bug fashion next to the oscillator coil on the i-f amplifier board ground foil. The results were great; with this meter circuit to evaluate this system, we had a relative quality indication to adjust our system's operation.

I have provided a circuit board for this op-amp stage to simplify construction (see Fig. 2 for the artwork and layout of the signal-strength indicator assembly). The PC

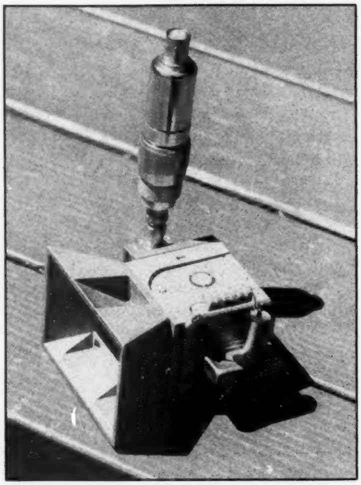


Photo D. Microwave circulator in its simplest use as a 10-GHz transceiver. This unit uses a Microwave Associates 10-mW Gunn source, a surplus circulator, a detector, and a small horn antenna. The impedance matching screw is also used for receiver "LO" injection into the detector.

board is mounted adjacent to pin 12 for short connection leads. The circuit is a simple peak detector and gives good results for tuning indications. See Fig. 3 for details on the 30-MHz i-f amplifier.

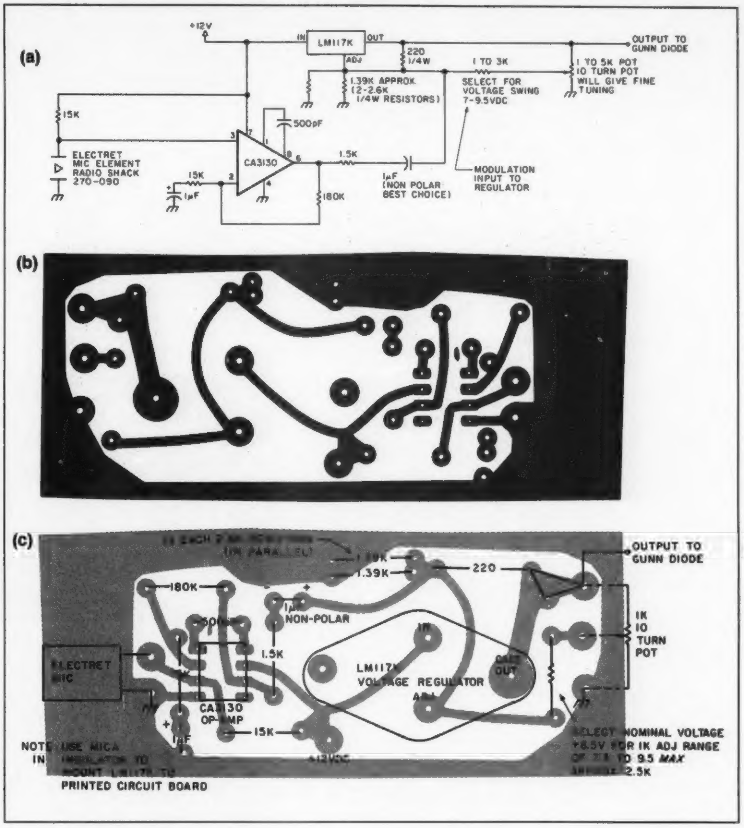

(a)
+12V
IN
LM117K
OUT
ADJ
OUTPUT TO GUNN DIODE
220 1/4W
1 TO 3K
1 TO 5K POT 10 TURN POT WILL GIVE FINE TUNING
1.39K APPROX. (2-2.6K 1/4W RESISTORS)
SELECT FOR VOLTAGE SWING 7-9.5VDC
15K
500pF
ELECTRET MIC ELEMENT RADIO SHACK 270-090
CA3130
1.5K
15K
1µF
1µF (NON POLAR BEST CHOICE)
MODULATION INPUT TO REGULATOR
180K
(b)
(c)
(IN PARALLEL)
1.39K
220
OUTPUT TO GUNN DIODE
180K
1µF NON-POLAR
1K 10 TURN POT
ELECTRET MIC
1.5K
LM117K VOLTAGE REGULATOR
OUT
ADJ
CA3130 OP-AMP
15K
1µF
+12VDC
NOTE: USE MICA INSULATOR TO MOUNT LM117K TO PRINTED CIRCUIT BOARD
SELECT NOMINAL VOLTAGE +8.5V FOR 1K ADJ RANGE OF 7.5 TO 9.5 MAX
2.5K

Fig. 4. Power supply modulator (a) schematic, (b) circuit board, foil side, and (c) parts placement.

P/S Modulator

The power-supply modulator for the Gunn diode consists of a single op-amp microphone amplifier whose output is coupled to the ADJUST terminal of a variable voltage regulator. A very small change in ADJUST terminal voltage will produce a change in output voltage, causing the Gunn diode to be frequency modulated just fine. See Fig. 4 for modulator diagram and parts layout.

The power-supply modulator was used with a Radio Shack electret microphone (costing 99 cents) and attached to an alligator clip with some miniature coax—nothing said we had to use expensive components! Testing the power supply consists of making sure that the output voltage using the fixed resistors is about 8 to 8.5 volts. With a potentiometer tied from the output of the supply to ground (1 to 5k pot) and its center wiper tied to a series resistor back to the adjust terminal (3k, 1/4 W), you will be able to vary the voltage of the regulator over a range set by proper selection of the fixed 1/4-W resistor. You want the minimum voltage to be about 7 volts and the upper limit about 9.5 to 10 volts. This is the approximate range at which most Gunn diodes deliver power, and it allows a frequency-tuning control other than screws on the cavity for fine-frequency setting.

Modulation is applied in much the same manner as in the fine-frequency setting above, but follows the amplitude variations from the mike amplifier; it changes the voltage regulator ever so slightly, producing frequency modulation and deviating the Gunn diode. Needless to say, it is wideband operation; but it is simple and it works very well.

The total system was operated from a lead-acid, 12-volt battery (2-1/2-Ah capacity), which I obtained surplus. This provided many days of operation without recharging. Normal current drawn for a Gunn diode with an output of 10 mW is 140 mA, 25 mW is 400 mA, 50 mW is 600 mA, and 100 mW is 800 mA. As you can see, with higher-output Gunn diodes, thermal considerations become very necessary and improved heat sinks are needed to dissipate the heat.

Preamplifier

The i-f preamplifier that I used was created by Jim Fisk W1HR and appeared in the October, 1978, issue of *Ham Radio*. The article listed a special transistor for the input stage, which I was not able to obtain, so I used an MRF-901. With a little taming, it worked very well. I wish I could have tried the transistors specified, as they would be the best choice for optimum performance. Several other types of transistors have also been used with good results. The output transistor I used was a plain old 2N2222. The preamp oscillated at first; in order for the MRF-901 transistor to be stable, its emitter lead had to be grounded right at its case. See Fig. 5 for the schematic diagram.

Many other amplifiers could be used (even the 40673 MOSFET), and I suspect most people will just pick up a pre-made 30-MHz amplifier from one of the many manufacturers of preamps. Their cost is so low it almost makes it too expensive to build one after you've gathered the parts. Whatever your choice, mount the preamplifier in a shielded box as close to the mixer diode connection as practical, keeping the leads very short to avoid stray i-f pickup.

Checkout

Each part of the system can be checked out by itself before you package the entire system. As squelch is not desired, disable the mute circuit on the i-f amplifier board by tying the 10k resistor on pin 1 of the TDA7000 amp to plus 5 volts. Couple a signal generator at 30 MHz into the amplifier and set the oscillator coil for output indication. Sensitivity should be about 2 to 3 microvolts for good quieting. Attach the preamplifier and check out its gain improvement to the system.

The completed system can be tuned up with some simple small horn antennas on a test range (I use my garage). To check the output from your Gunn diode transmitter, connect a small horn antenna to a diode detector to which a 50-microamp meter is tied. The meter reads the diode-rectified current that is developed from your transmitter. Start with your antennas spaced, say, at three feet (very small horn antennas) and find where the focus point is. Then, to tune for maximum output, secure your units with a vise or some suitable mount while you tune the adjusting screws to match your systems. If your meter is too sensitive, increase the distance between the antennas (power falls off as the square of the distance). With some experience, you can use the distance to estimate the power of your unit.

If you know that at four feet you produce 25 microamps of current with a 10-milliwatt Gunn diode and that at eight feet you get the same reading with the same antennas, you know that this source is about 100 milliwatts of power. Of course, this is a rather crude measurement, but if there is no other means of determining relative power, you use what you have available.

10-GHz Communications

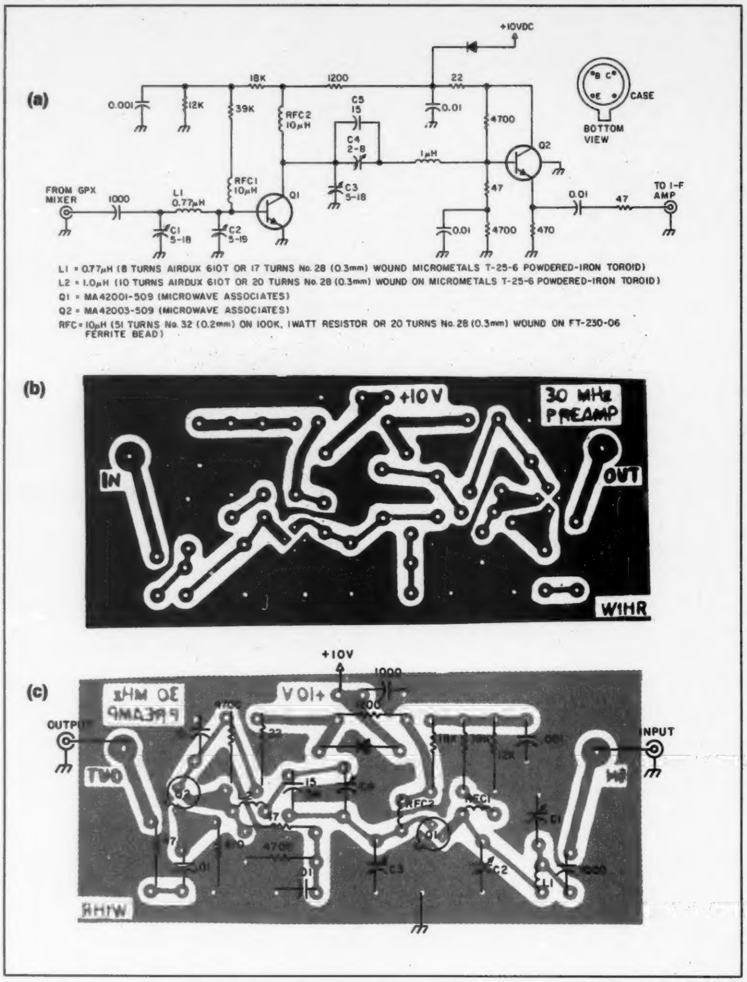
Kerry N6IZW and I started out with a garage contact on 10 GHz, and before the day was over we had worked up our distance to about three blocks. That was before we installed the i-f preamplifier. With the preamps installed, we worked a path of several miles with rock-crushing signals. The alligator clip mike worked so well we didn't change it; if you use shielded coax for the lead and a shielded box to house the components, interference should not be a problem.

With our system mounted on top of the diode mounts and the printed circuit boards unshielded for short contacts of four to five miles, it performed quite well. However, when we tried for a 15-mile path, we experienced severe FM broadcast interference feeding through the system. My system is still unshielded and I have yet to heed my own advice.

One particularly fun contact was when we went to our local San Diego swap meet and operated hand-held portable on 10 GHz. Kerry and I had mounted two 5–10-dB-gain horn antennas on the cavity for the Gunn diode transceiver and pointed them skyward while we walked around the swap meet. There were a lot of questions, and we hoped to increase interest in operation on 10 GHz. Though our contacts were short-range, we were provided with many great eyeball QSOs.

I will make Gunn diodes available to amateurs for $5 each postpaid in the continental U.S. These devices provide between 50 and 100 milliwatts of output power in a suitable Gunn mount as described in this article. The diodes are about .3 inches long—like a 3-48 screw without a head. A printed circuit board etched and ready for drilling is also available. It includes the original i-f amp, PS modulator, and S-meter circuit incorporated onto one PC board, plus the TDA-7000 chip. The cost is $10.

I would be happy to answer any questions concerning this or any other related project. Please enclose an SASE for a prompt reply. ■



L1 = 0.77μH (8 TURNS AIRDUX 610T OR 17 TURNS No. 28 (0.3mm) WOUND MICROMETALS T-25-6 POWDERED-IRON TOROID)
L2 = 1.0μH (10 TURNS AIRDUX 610T OR 20 TURNS No. 28 (0.3mm) WOUND ON MICROMETALS T-25-6 POWDERED-IRON TOROID)
Q1 = MA42001-509 (MICROWAVE ASSOCIATES)
Q2 = MA42003-509 (MICROWAVE ASSOCIATES)
RFC = 10μH (51 TURNS No. 32 (0.2mm) ON 100K, 1WATT RESISTOR OR 20 TURNS No. 28 (0.3mm) WOUND ON FT-230-06 FERRITE BEAD)

Fig. 5. 30-MHz i-f preamplifier (a) schematic, (b) circuit board, foil side, and (c) parts placement. Courtesy of Ham Radio *Magazine, J. R. Fisk W1HR, October, 1978, p. 38.*

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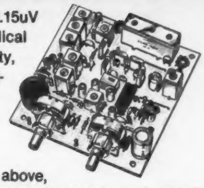

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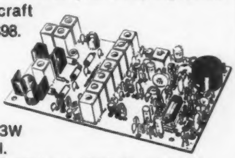

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50-54	144-148
144-146	28-30
145-147	28-30
144-144.4	27-27.4
146-148	28-30
220-222	28-30
220-224	144-148
222-226	144-148
220-224	50-54
222-224	28-30

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435-437	28-30
432-436	144-148
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28-29	145-146
28-30	50-52
27-27.4	144-144.4
28-30	220-222*
50-54	220-224
144-146	50-52
144-146	28-30

For UHF,
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Exciter Input Range	Antenna Output
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28-30	435-437
61.25	439.25
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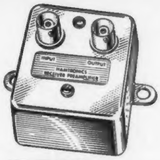

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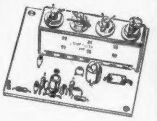

MODEL	TUNING RANGE	PRICE
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HRA–(*)	450–470 MHz	$64

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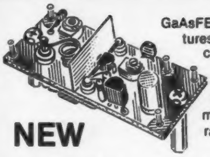

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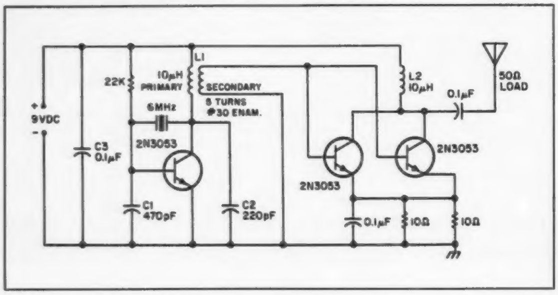
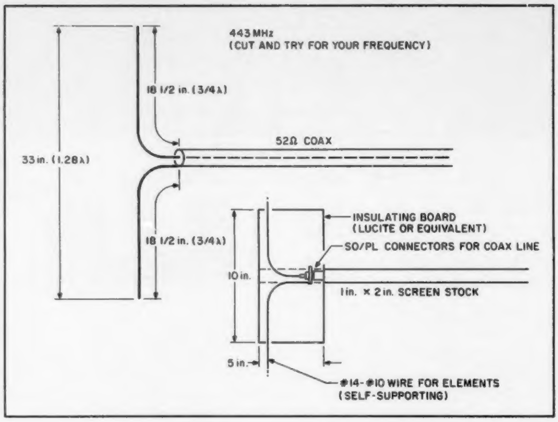


+ 9VDC -
C3 0.1µF
22K
10µH PRIMARY
L1
SECONDARY 5 TURNS #30 ENAM.
6MHz
2N3053
C1 470pF
C2 220pF
L2 10µH
0.1µF
50Ω LOAD
2N3053
2N3053
0.1µF
10Ω
10Ω

Fig. 1. One-Watt CW transmitter.

Fig. 1 is a little transmitter that could be put into a plastic Easter egg. This transmitter delivers approximately 1 Watt of measured rf output into a 50-Ohm dummy load, and creates no heating problems with the circuit. The crystal is a series fundamental type, and the power source is a 9-volt at 2-Amp supply. The transmitter can operate at another frequency, but C1 and C2 may have to be changed for it to work properly. The secondary of L1 was wound over the center of a 10-uH coil, with five turns of 30-gauge enameled wire. Most of the parts were bought at Radio Shack, except for the crystal, which came from Jameco Electronics.

James H. Brown
Rockford IL



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5 in.
#14-#10 WIRE FOR ELEMENTS (SELF-SUPPORTING)

Fig. 2. 450-MHz extended double zepp.

Sometimes old-fashioned methods work. When WB4AKA wanted a super simple side-mounted transmitting antenna for his UHF repeater, he and I turned to the old extended double zepp. Handbooks show the optimum length as 1.28 wavelengths, but they also assume you will use wide-spaced tuned lines. That was typical on 40 meters in 1938, but now we are on UHF and using coax. How can we match this odd impedance?

We tried several ideas involving stubs and shorting bars and Delta matching sections, and finally reduced this to sheer simplicity with a curved matching section. It is probably theoretically a hyperbola, but any reasonably smooth curve should do. Just avoid any abrupt discontinuities (such as the Delta match offered).

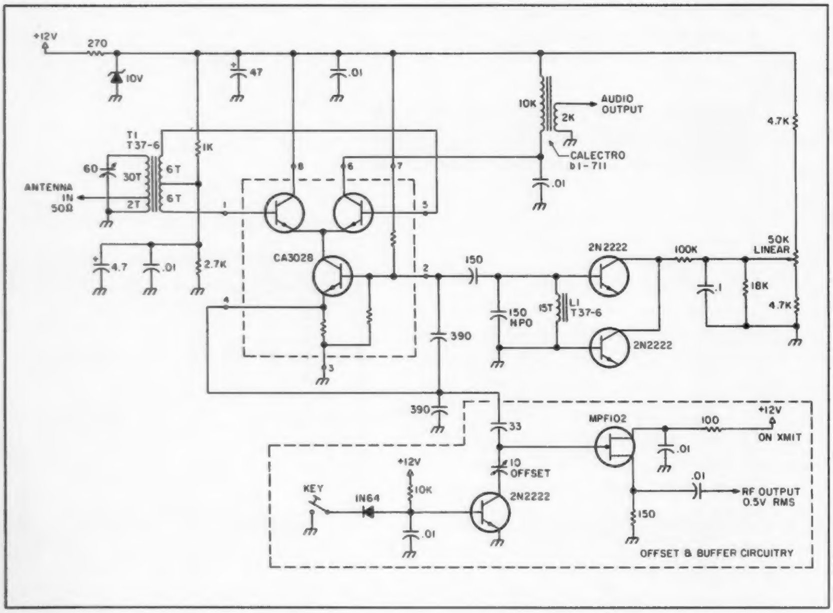
Construction is easy. Cut two stiff wires (such as #10 house wire) 18-1/2" long. This is 3/4 wavelength and thus matches the coax nicely. Then curve out from the coax connector so that the end-to-end length is 33". This is the desired 1.28 wavelength. Slight pruning or squeezing of the curve gave us dead flat swr. You must measure to be sure. On these frequencies, there is no such thing as a cut-and-trust antenna. For different frequencies, use the same approach—3/4 wavelength legs and 1.28 overall spread.

We supported this on a 1" x 2" boom and a piece of insulating board (any kind will do). Cement the antenna to the board, or drill small holes and tie it on, or do whatever you like.

William Bruce Cameron WA4UZM
Temple Terrace FL

The simple design in Fig. 3 combines the functions of vfo and product detector on a single CA3028 (LM3028) IC. The Seiler oscillator (configured for 30 meters, but scalable) is varicap-tuned to provide about a 35-kHz range, and has good tuning linearity and better band-spread than a tuning capacitor because a pot has a 270-degree tuning range. Compact or spread the turns on L1 to trim the frequency into the band, then coat them with dope. Use NPO capacitors for best stability. Vfo pulling is minimal under strong signal conditions. Balanced input at T1 minimizes vfo radiation into the antenna. Use this in your next direct-conversion receiver, or add the circuitry for offset and buffering in your next QRP transceiver design.

Chris Iwata KL7DM
Anchorage AK



+12V
270
10V
47
.01
10K
2K
AUDIO OUTPUT
CALECTRO D1-711
.01
4.7K
T1 T37-6
60
30T
2T
6T
6T
ANTENNA IN 50Ω
1K
8
6
7
1
5
CA3028
4.7
.01
2.7K
2
4
3
150
390
150 NPO
15T
L1 T37-6
2N2222
2N2222
100K
.1
18K
50K LINEAR
4.7K
390
33
MPF102
100
+12V ON XMIT
.01
10 OFFSET
+12V
10K
KEY
1N64
.01
2N2222
.01
RF OUTPUT 0.5V RMS
150
OFFSET & BUFFER CIRCUITRY

Fig. 3. Vfo/product detector on a chip.

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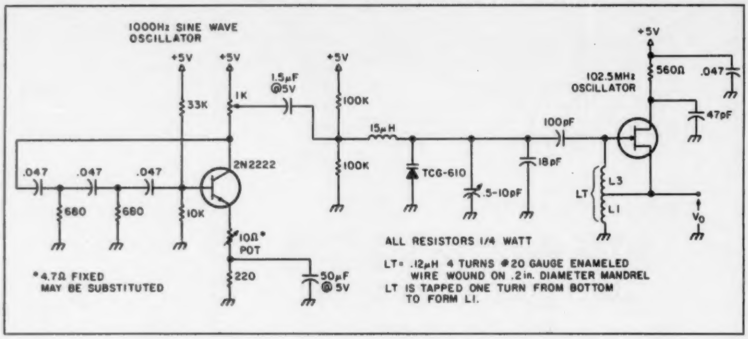
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Fig. 5. A one-transistor FM transmitter.

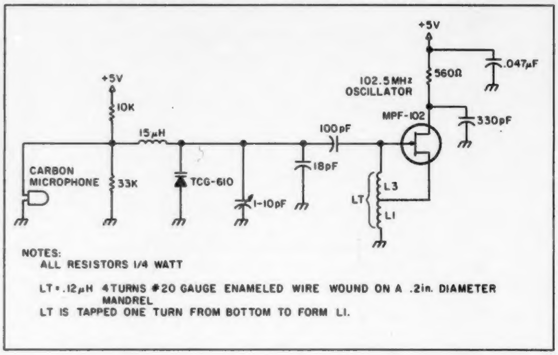
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Fig. 6. Modified transmitter, using a carbon microphone.

While employed at Pegasus Data Systems, I was asked to design a simple, convenient, low-cost FM transmitter that could test a large number of vendor-supplied FM receivers that were to be incorporated into a digital data-transmission system. The transmitter had to make a subjective check of the accuracy of the tuning-dial setting and the sensitivity of each receiver unit. Since it might become necessary to perform field tests, interconnecting various pieces of bulky and heavy test equipment was an undesirable alternative.

To meet the requirement, I designed, built, and tested the transistor circuit shown in Fig. 5. The 2N2222 circuitry is a three-element phase-shift oscillator circuit, designed to yield a 1,000-Hz sine wave. The 1,000-Hz sine wave is then applied to the TCG-610 varactor diode (6 pF at 4 volts), which changes the tank capacitance, thus varying the rf oscillator frequency at a 1,000-Hz rate. The 1,000-Ohm potentiometer in the collector circuit may be adjusted to enable the desired frequency modulation level.

The Hartley rf oscillator, designed around a readily available MPF-102 JFET, has an output that should be relatively stable if it is enclosed in a metal box (thus minimizing changes in tank capacitance). The completed transmitter has a range of 30 feet when not enclosed (but without an antenna). When enclosed, a BNC or F connector can be used to feed the rf to a small loop. If you decide to build this unit, be careful, the FCC has regulations regarding the radiation of rf.

One of my colleagues, Bohdan Stryzak, modified the transmitter by eliminating the sine-wave-oscillator portion and replaced it with a carbon microphone as shown in Fig. 6. This created for his children a three-dollar portable transmitter that could be used with any portable FM receiver as a handie-talkie.

William Rynone, PhD
Annapolis MD

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*Touch-Tone is trademark of AT&T

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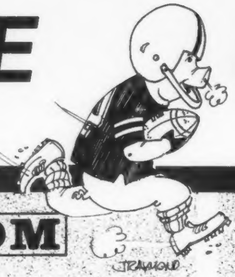

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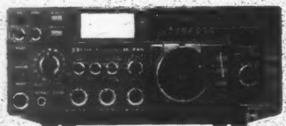

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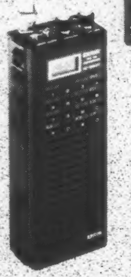

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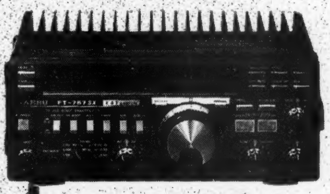

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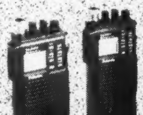

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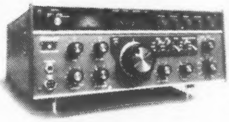

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1987 WORLD SSB CHAMPIONSHIPS

Announcing the January Classics—the 1987 running of the World SSB Championships! The first and only contests of their kind, these six individual single-band events are world-renowned and amongst the most challenging events on the bands today. Winners of each contest determine the World Champion for 10-, 15-, 20-, 40-, 75-, and 160-meter single sideband:

0000 UTC January 3, 1987
through 2400 UTC January 4, 1987
1st 10-Meter World SSB Championship

January 10, 1987
0000–2400 UTC
3rd 15-Meter World SSB Championship

January 11, 1987
0000–2400 UTC
3rd 20-Meter World SSB Championship

0000 UTC January 17, 1987
through 2400 UTC January 18, 1987
8th 160-Meter World SSB Championship

January 24, 1987
0000–2400 UTC
6th 40-Meter World SSB Championship

January 25, 1987
0000–2400 UTC
6th 75-Meter World SSB Championship

MISC. RULES:

Stations may be worked only *once per event*. All contacts must be two-way SSB transmissions. All stations, regardless of their operating class, may operate entire contest periods without a rest period.

OPERATOR CLASS:

(a) Single operator, single transmitter, SSB only. (b) Multi-operator, single transmitter, SSB only.

EXCHANGE:

Stations within the continental 48 U.S. states and 13 Canadian provinces or territories transmit RS report and state, province, or territory. All others, including Alaska and Hawaii, transmit RS report and DX country.

QSO POINTS:

5 QSO points for contact within your own continent, 10 QSO points for contact outside your own continent.

MULTIPLIER:

1 multiplier point is earned for each continental U.S. state (48 max.), Canadian province or territory (13 max.), or ARRL DXCC country (excluding the United States or Canada).

DX WINDOW:

For the purpose of this event, DX window frequencies are reserved for *split-frequency operation only*. W/VE stations are not to transmit in the DX window. DX stations may transmit in the DX window but *must* receive *outside* window frequencies. DX Windows: 7.080–7.090, 3.790–3.805, 1.825–1.830, 1.850–1.855, and 1.907–1.913 MHz.

FINAL SCORE:

Total QSO points x multiplier points = claimed score.

CONTEST ENTRIES:

Entries must include (1) a contest log, (2) a dupe sheet for 100 or more contacts, (3) a list of multipliers, and (4) a summary sheet as outlined below. Be sure to include your soapbox comments and a black-and-white photo for possible publication.

SUMMARY SHEET:

Summary Sheets must contain (1) contest callsign, (2) your QTH, (3) station owner's name and address, (4) a list of station equipment and antennas, (5) operator class, (6) total QSO points, (7) total U.S. states worked, (8) Canadian provinces and territories worked, (9) the total of ARRL DXCC countries worked, (10) total multiplier points, (11) claimed score, and (12) if a multi-operator station, a list of participants, by callsign.

ENTRY DEADLINE:

Mail contest entries separately to the contest chairman listed below. Entries must be *postmarked no later than February 18, 1987*. Late entries will be registered as check logs.

DISQUALIFICATION:

Contestants may be disqualified if they run illegal power, cause deliberate interference, fail to comply with the DX window rules, attempt to achieve a scoring advantage, or if the number of duplicate contacts not cancelled exceeds more than 3% of the total contacts made. Contest committee decisions are final.

PENALTIES:

A penalty of 100 QSO points will be assessed for *each* duplicate contact counted in a contestant's claimed score.

AWARDS:

A minimum of 100 QSOs must be worked in an event to be eligible for certificates. Plaques will be issued to World Championship stations who work a minimum of 500 contacts. Awards will be issued in each operator class, in each continental U.S. state, Canadian province and territory, and ARRL DXCC country represented.

RULES AND FORMS:

Contestants are encouraged to *send an SASE* for official forms to:

Bill Gosney KE7C
World Championship Contests
2665 North Busby Road
Oak Harbor WA 98277

Mail each entry to the appropriate contest chairman:

10-Meter Contest Chairman
Linda Ingram KG6MO
44720 N. 11th Street East
Lancaster CA 93535

15-Meter Contest Chairman
Gary Vest NW5E
Star Route, Box 34
Holliday TX 76366

20-Meter Contest Chairman
Chuck Ingram WA6R
44720 N. 11th Street East
Lancaster CA 93535

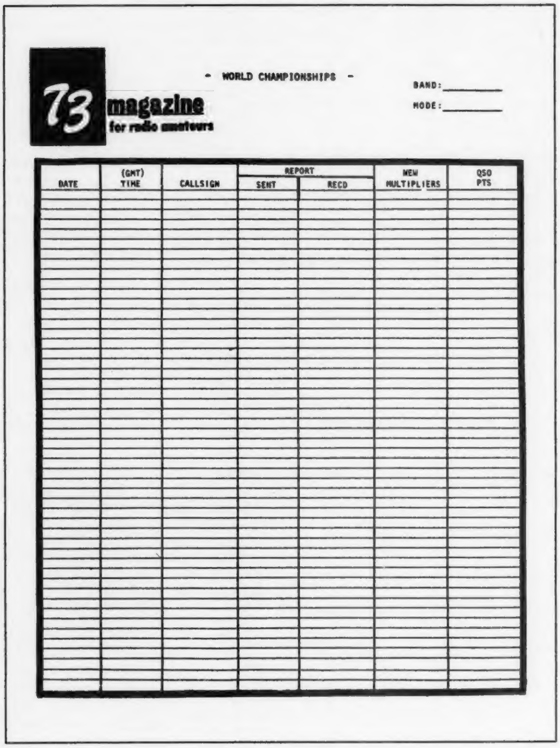
40-Meter Contest Chairman
Dennis Younker NE6I
43261 6th Street East
Lancaster CA 93535

75-Meter Contest Chairman
Ron Johnson KC7PA
68 South 300 West
Brigham City UT 84302

160-Meter Contest Chairman
Bill Gosney KE7C
2665 N. Busby Road
Oak Harbor WA 98277

N5AU, KS9O, ZS6BPL, and NP4P —40-Meter World Champions—

This year was a typical Texas standoff! N5AU became the World Single-Operator Champion by depriving two-time record holder KE5CV of his third consecutive world title. KE5IV, last year's runner-up, had to settle for third place this time around. All three Lone Star stations were neck and neck in the closing hours of the contest. Guess it's true that



73 magazine
for radio amateurs

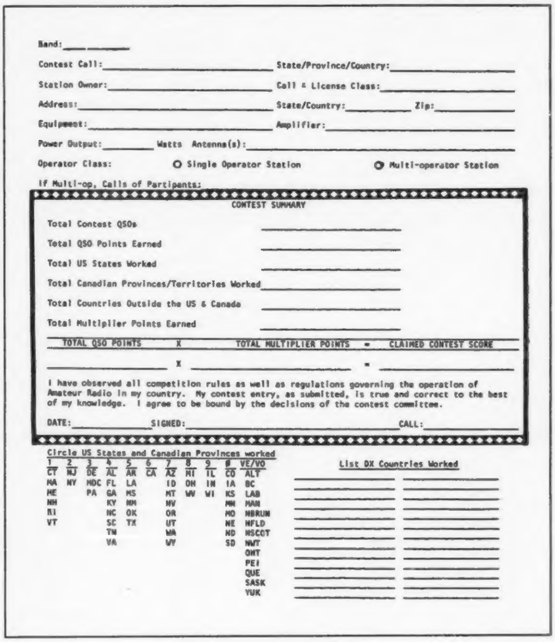
- WORLD CHAMPIONSHIPS -

BAND:__________

MODE:__________

DATE	(GMT) TIME	CALLSIGN	REPORT		NEW MULTIPLIERS	QSO PTS
			SENT	RECD		

Sample log sheet.



Band:__________

Contest Call:__________ State/Province/Country:__________

Station Owner:__________ Call & License Class:__________

Address:__________ State/Country:__________ Zip:__________

Equipment:__________ Amplifier:__________

Power Output:__________ Watts Antenna(s):__________

Operator Class: ○ Single Operator Station ○ Multi-operator Station

If Multi-op, Calls of Partipants:

CONTEST SUMMARY

Total Contest QSOs __________

Total QSO Points Earned __________

Total US States Worked __________

Total Canadian Provinces/Territories Worked__________

Total Countries Outside the US & Canada __________

Total Multiplier Points Earned __________

TOTAL QSO POINTS X TOTAL MULTIPLIER POINTS = CLAIMED CONTEST SCORE

__________ X __________ = __________

I have observed all competition rules as well as regulations governing the operation of Amateur Radio in my country. My contest entry, as submitted, is true and correct to the best of my knowledge. I agree to be bound by the decisions of the contest committee.

DATE:__________ SIGNED:__________ CALL:__________

Circle US States and Canadian Provinces worked

1	2	3	4	5	6	7	8	9	0	VE/VO
CT	NJ	DE	AL	AR	CA	AZ	MI	IL	CO	ALT
MA	NY	MDC	FL	LA		ID	OH	IN	IA	BC
ME		PA	GA	MS		MT	WV	WI	KS	LAB
NH			KY	NM		NV			MN	MAN
RI			NC	OK		OR			MO	NBRUN
VT			SC	TX		UT			NE	NFLD
			TN			WA			ND	NSCOT
			VA			WY			SD	NWT
										ONT
										PEI
										QUE
										SASK
										YUK

List DX Countries Worked

Sample summary sheet.

everything's big in Texas, including the scores!

N5AU led KE5CV by only 136 QSOs at the finish, enough to outweigh the multipliers earned by his second-place rival. Both stations had 56 states and provinces; however, Mike KE5CV held the advantage in DX countries worked—37 to N5AU's 32.

KS9O became the unchallenged Multi-Op Champion with a total of 1,031 QSOs, 57 states and provinces, 23 DX countries, and a total score of 424,000 points. K3TUP, World Champion for the past three years, apparently wasn't able to turn out but did manage to get some activity in on the other events. KS9O had smooth sailing throughout the contest. Following by a wide margin was well-known 15/20-meter World Champ, K5LZO—another one of those Texas powerhouses! Hi, Chuck!

ZS6BPL earned the World Championship for DX single-op stations with 400 QSOs, 44 states, and 43 DX countries, while Puerto Rican station NP4P took multi-op honors for the event. ZS6BPL had the greatest competition to face. He and I4RYC had identical multiplier counts of 87 and ZS6BPL led by only 44 QSOs. The key factor: ZS6BPL worked more stations out of his own continent. NP4P took a comfortable lead at the very start and remained unchallenged throughout the evening. As Table 2 shows, this is the first year the world multi-op championship has been awarded outside Italian borders. Will Italy get it back next year?

In championship level competition, it is no surprise when someone breaks a world record. This year is no exception. N5AU and KE5CV both surpassed the world 40-meter QSO record established last year.

Single Operator:		
N5AU	1986	1,397
KE5CV	1986	1,261
KE5CV	1985	1,200
K4XS	1985	1,196
KE5IV	1986	1,151
W1WEF	1984	1,042
KE5CV	1984	1,020
N6YK	1985	1,012
VE5DX	1982	972
KE5IV	1984	953
Multi-Operator:		
K3TUP	1985	1,381
K3TUP	1983	1,214
K3TUP	1984	1,196
N4DDS	1985	1,151
KY0S	1985	1,139
K8ND	1983	1,129
N9NB	1982	1,098
W2ZQ	1985	1,064
KS9O	1986	1,031
K9EC	1984	1,008

As always, Canadian multipliers were at a premium. VE1s, VE5s, and VE8s (Bob VE8DX, where were you?) were about as rare as Clipperton Island. Stations with 50 or more states and provinces to their multiplier credit include: KS9O (57); NK7U, N5AU, KE5CV, KE5IV, and KV0I (56 each); K5LZO, K6HNZ, and KQ1F (55); NC9F, K1KJT, and WI4R (54); W8RA, WA3SPJ, and N2BOW (53); N6AOI and KA7DLV (52); NC2V, WA2HFI, and WD4KXB (51); and NT5D (50).

DX country multipliers were extremely hard to find. Six months before the contest announcements were mailed to more than 50 publications worldwide. The contest was well publicized, yet it seems we still have to convince DX stations to work split-frequency—to listen for stations above 7.150 MHz. Leading the field with 30 countries or more were: DJ3HJ (53), I4RYC (51), ZS6BPL (43), KE5CV (37), JA3YKC (36), N5AU (32), W8RA and W6MKB (31), and KE5IV (30).

Speaking of split-frequency, it is worth noting that many stations are not observing the DX window frequencies as they were intended for this contest. *DX stations may only transmit and non-DX stations may only listen in the DX windows.* Unfortunately, this rule has been either misinterpreted or ignored by some stations and we had to disqualify them. We hated to do it, but rules are rules, and the integrity of these Championship events cannot allow deviations or special allowances.

Being an antenna nut myself, I look forward to conducting the antenna survey each year. With the help of Contest Chairman NE6I, here are the tabulated results extracted

Overall Winners—Single Operator:			
USA	KE5CV	85	704,520
Canada	VE3MFP	85	227,420
DX	ZS6BPL	86	340,605
Overall Winners—Multi-Operator:			
USA	K3TUP	85	597,240
Canada	VE2ZP	82	86,355
DX	I4KDJ	84	545,090
W/VE Stations—Single Operator:			
AL	KA4RKD	82	16,080
AR	KD0HY	86	68,000
AZ	WB7APW	85	132,370
CA	N6YK	85	539,400
CO	K9MWM/0	84	239,600
CT	W1WEF	84	434,320
DE	AC3T	86	123,300
FL	K4XS	85	567,840
GA	K4JPD	84	197,210
IA	KD0HY	85	99,680
ID	KJ7R	82	9,333
IL	KB8AC	85	95,410
IN	N9GT	85	236,375
KS	N0CLV	85	28,595
KY	KD4TQ	84	214,620
LA	NS5Z	85	64,435
MA	KA1GG	85	303,680
MD	K3ZO	86	72,610
ME	KS1G	84	62,405
MI	N8CXX	85	202,620
MN	KA7DLV	86	129,640
MS	AE5H	85	142,680
MT	KS7T	85	35,860
NC	W4TMR	84	140,080
NE	K0HA	85	338,000
NH	AK1A	85	103,740
NJ	NC2V	85	344,520
NM	W5TTE	85	74,800
NV	KD7SP	85	75,330
NY	WA1BBB	85	108,330
OH	WD8IVL	84	187,860
OK	N5AFV	85	21,800
OR	KI7M	84	207,025
PA	KI2G	84	236,250
RI	KA1SR	85	98,820
SC	W4TWW	85	13,440
TN	N4JII	85	137,200
TX	KE5CV	85	704,520
UT	KC7PA	85	77,000
VA	WD4KXB	86	122,220
VT	KT1J	84	106,335
WA	N7EMX	84	20,600
WI	K9EC	85	317,560
WV	NJ8N	86	225,455
WY	KB7M	85	43,665
ALT	VE6CPP	86	8,190
BC	VE7BBD	86	2,945
LAB	VO2CW	83	29,326
MAN	VE4RP	83	9,576
NB	VE1AJJ	82	9,308
NS	VE1NG	86	65,280
ONT	VE3MFP	85	227,420
QUE	VE2YU	85	39,480
YUK	VY1CW	86	1,860
W/VE Stations—Multi-Operator:			
CA	KE6WA	84	188,430
CO	KY0S	85	512,940
FL	WA4JXI	85	468,585
IL	KS9O	86	424,000
IN	N9NB	82	112,965
KY	KD4TQ	82	95,432
LA	KD5RW	86	43,930
MI	W8RA	86	317,100
NC	NW4B	84	433,875
NJ	W2ZQ	85	359,700
NY	N2EIK	84	66,865
OH	K8ND	83	113,646
OR	NK7U	86	319,125
PA	K3TUP	85	597,240
RI	KK1B	84	17,820
SD	KB0QA	84	173,565
TN	N4DDS	85	385,770
TX	WD5GSL	85	342,005
VA	NA4L	84	342,735
VT	WB1GMH	83	9,898
WA	KE7C	84	48,900
WI	K9EC	84	449,360
WY	KB7M	84	19,075
QUE	VE2ZP	82	86,355
DX Stations—Single Operator:			
Alaska	KL7U	85	187,000
Australia	VK5BW	82	13,158
Austria	OE1WWL	84	14,580
Brazil	PY5EG	83	69,064
Bulgaria	LZ1KKA	85	17,640
Cayman Is.	ZF2GO	85	30,590
Ceuta	EA9KQ	84	39,565
Czech.	OK1TN	84	137,610
Denmark	OZ3ZK	85	3,920
Dom. Rep.	HI4AGE	82	24,603
East Germany	Y33TA	84	22,080
Ecuador	HC1OT	86	74,790
England	G4IVJ	84	14,260
France	FE6BVB	85	6,375
Guam	KD7P/KH2	84	228,200
Hawaii	KH6DW	86	27,170
Honduras	HR1FC	85	34,860
Indonesia	YC0DPO	86	34,580
Israel	4X6DK	84	10,030
Italy	I4RYC	86	270,570
ITU/Geneva	4U1ITU	84	167,440
Japan	JH3TKM	84	41,085
Korea	HL1ABR	86	4,585
Luxemberg	LX1JX	84	48,345
Montserrat	K3WGR/VP2M	85	176,175
Morocco	CN8CO	82	61,008
Netherlands	PA3CEF	85	600
New Zealand	ZL1BQD	84	90,630
Norway	LA5YF	82	32,319
Philippines	KF6ME/DU	85	45,960
Poland	SP9FIH	86	6,100
Portugal	CT4NH	83	74,888
Romania	YO9CUF/3	82	230
Solomon	H44SH	82	37,765
So. Africa	ZS6BPL	86	340,605
Spain	EA3CCN	84	76,250
Sweden	SM4CAN	82	690
Venezuela	4M3AZC	83	124,805
West Germany	DJ3HJ	85	284,375
Yugoslavia	YU3CK	85	20,200
DX Stations—Multi-Operator:			
Alaska	AL7DX	84	34,125
Australia	VK6IR	85	128,750
Costa Rica	TI2DCR	86	39,790
Czech.	OK1KSO	84	307,020
England	G0AGH	86	1,595
Italy	I4KDJ	84	545,090
Japan	JA7YFB	85	19,075
Korea	HL9FY	84	20,200
Puerto Rico	NP4CC	84	217,005
West Germany	DL8NBE	84	194,220

Table 1. 40-meter honor roll—all-time record holders. (Columns show QTH, callsign, year, and score.)

40-meter world single-op DX champion ZS6BPL.

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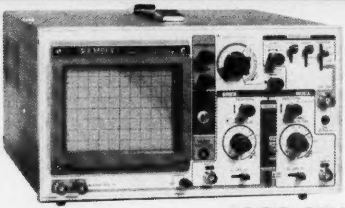
RAMSEY ELECTRONICS

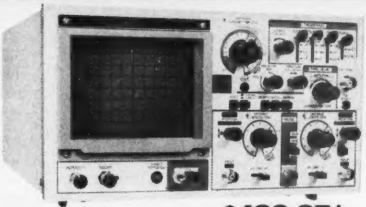
QUALITY TEST GEAR YOU CAN COUNT ON



INCLUDES 2 HOOK-ON PROBES **$369.95***

20 MHz DUAL TRACE

Features component testing circuit for resistors, capacitors, digital circuits and diodes—TV sync filter—high sensitivity—Z axis—XY mode—built-in calibrator—5X horizontal magnifier



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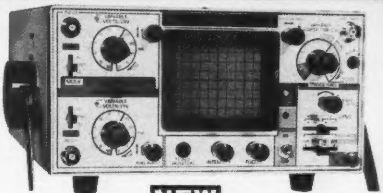
35 MHz DUAL TRACE

wide frequency bandwidth—optimal sensitivity —delayed triggering sweep—hold off—ALT trigger—single sweep TV sync 5X magnification—XY or XYZ operation— HF/LF noise reduction



NEW

INCLUDES 2 HOOK-ON PROBES **$449.95***

15 MHz DUAL TRACE PORTABLE

Field/bench applications—built-in charger and battery pack—up to 2 hours operation per charge—5X horizontal magnification—high brightness CRT—front panel trace rotator

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All Ramsey oscilloscopes feature unsurpassed quality at an unbeatable price. Of heavy duty construction, they are suitable for hobby, service and production applications.

***Add an additional $10.00 for each unit for shipping.**

MODEL	BAND WIDTH	# TRACES	CRT SIZE	VERTICAL SENSITIVITY	MAXIMUM TRIG FREQ	USEABLE MAXIMUM BANDWIDTH
2200	20 MHz	(2)	8x10CM	5 mV per div	35 MHz	30 MHz
2500	15 MHz	(2)	3.5 inch	2 mV per div	30 MHz	25 MHz
3500	35 MHz	(2)	8x10CM	1 mV per div	50 MHz	60 MHz

All include high quality 1:1, 10:1 hook on probes, instruction/service manual with schematic and component layout. 1 year warranty.

MINI-100 COUNTER

$119.95 CHARGER, NICAD BATTERIES, AC ADAPTER INCLUDED

CT-70 7 DIGIT 525 MHz

$139.95 WIRED, INCLUDES AC ADAPTER

CT-90 9 DIGIT 600 MHz

$169.95 WIRED INCLUDES AC ADAPTER

CT-50 8 DIGIT 600 MHz

$189.95 WIRED INCLUDES AC ADAPTER

CT-125 9 DIGIT 1.2 GHz

$189.95 WIRED INCLUDES AC ADAPTER

MODEL	FREQ RANGE	SENSITIVITY	ACCURACY	DIGITS	RESOLUTION	PRICE
MINI-100	1-500 MHz	Less than 250mv	1 PPM	7	100 Hz, 1 KHz	**119.95**
CT-70	20 Hz-550 MHz	< 50mv To 150 MHz	1 PPM	7	1Hz, 10Hz, 100Hz	**139.95**
CT-90	10 Hz-600 MHz	< 10mv To 150 MHz < 150mv To 600 MHz	1 PPM	9	0.1Hz, 1Hz, 10Hz	**169.95**
CT-50	5 Hz-600 MHz	LESS THAN 25 mv	1 PPM	8	1Hz, 10Hz	**189.95**
CT-125	10 Hz-1.25 GHz	< 25mv @ 50 MHz < 15mv @ 500 MHz < 100 mv @ 800 MHz	1 PPM	9	0.1Hz, 1Hz, 10Hz	**189.95**
CT-90 WITH OV-1 OPTION	10 Hz-600 MHz	< 10mv To 150 MHz < 150mv To 600 MHz	0.1 PPM	9	0.1Hz, 1Hz, 10Hz	**229.90**

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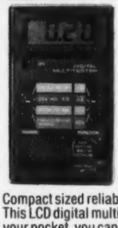
Ramsey Electronics has been manufacturing electronic test gear for over 10 years and is recognized for lab quality products at breakthrough prices. Our frequency counters have features and capabilities of counters costing twice as much.



RAMSEY D-4100 COMPACT DIGITAL MULTITESTER

$24.95

test leads and battery included

Compact sized reliability and accuracy. This LCD digital multitester easily fits in your pocket, you can take it anywhere. It features full overload protection • 3½ digit LCD readout • recessed input jacks • safety probes • diode check function • 2000 hours battery life

NEW

RAMSEY D-5100 HANDHELD DIGITAL AUTORANGING METER

$49.95

Includes Probes
1 Year Warranty

Provides distinctive audible chirp after contact has been made and meter reading has stabilized. Has TOUCH-HOLD feature to allow readings to be logged or referred to before making the next reading. Up to 10 AMP current capability and a continuity function which beeps on zero Ohms.

$44.95 wired includes AC adapter

PR-2 kit **$39.95**

PR-2 COUNTER PREAMP

The PR-2 is ideal for measuring weak signals from 10 to 1,000 MHz • flat 25 db gain • BNC connectors • great for sniffing RF • ideal receiver/TV preamp

$69.95 wired

PS-2 kit **$49.95**

PS-2 AUDIO MULTIPLIER

The PS-2 is handy for high resolution audio resolution measurements, multiplies Up in frequency • great for PL tone measurements • multiples by 10 or 100 • 0.01 Hz resolution & built-in signal preamp/conditioner

$89.95 wired includes AC adapter

PS-10B 1 GHz PRESCALER

Extends the range of your present counter to 1 GHz • 2 stage preamp • divide by 1000 circuitry • super sensitive (50 mV typical) • BNC connectors • 1 GHz in, 1 MHz out • drives any counter

MINI KITS—EASY TO ASSEMBLE—FUN TO USE—FOR BEGINNERS, STUDENTS AND PROS

TONE DECODER
A complete tone decoder on a single PC board. Features: 400-5000 Hz adjustable range via 20 turn pot, voltage regulation, 567 IC. Useful for touch-tone burst detection, FSK, etc. Can also be used as a stable tone encoder. Runs on 5 to 12 volts.

Complete kit, TD-1 **$5.95**

40 WATT 2 mtr PWR AMP
Simple Class C power amp features 8 times power gain 1 W in for 8 out, 2 W in for 15 out, 5 W in for 40 W out. Max output of 50 W, incredible value, complete with all parts, less case and T-R relay.

PA-1, 40 W pwr amp kit **$22.95**
TR-1, RF sensed T-R relay kit **6.95**

COLOR ORGAN
See music come alive! 3 different lights flicker with music. One light each for, high, mid-range and lows. Each individually adjustable and drives up to 300 W. runs on 110VAC.

ML-1 Kit, **$8.95**

VOICE ACTIVATED SWITCH
Voice activated switch kit provides switched output with current capability up to 100 mA. Can drive relays, lights, LED or even a tape recorder motor. Runs on 9 VDC.
VS-1 KIT

$6.95

VIDEO MODULATOR
Converts any TV to video monitor. Super stable, tunable over ch 4-6. Runs on 5-15V accepts std. video signal. Best unit on the market! Complete kit, VD-1 **$7.95**

LED BLINKY KIT
Alternately flashes 2 jumbo LEDs. Use for name badges, buttons, warning panel lights. Runs on 3 to 15 volts.

BL-1 Kit, **$2.95**

MAD BLASTER
Produces LOUD ear shattering and attention getting siren like sound. Can supply up to 15 watts of obnoxious audio. Runs on 6-15 VDC

MB-1 Kit **$4.95**

UNIVERSAL TIMER
Provides the basic parts and PC board required to provide a source of precision timing and pulse generation. Uses 555 timer IC and includes a range of parts for most timing needs.

UT-5 Kit **$5.95**

WHISPER LIGHT
An interesting kit, small mike picks up sounds and converts them to light. The louder the sound, the brighter the light. Includes mike, controls up to 300 W, runs on 110 VAC.

WL-1 Kit **$6.95**

FM WIRELESS MIKE
Transmits up to 300' to any FM broadcast radio, uses any type of mike. Runs on 3 to 9V. Type FM-2 has added sensitive mike preamp stage.

FM-1 Kit **$3.95**
FM-2 Kit **$4.95**

SIREN
Produces upward and downward wail. 5 W peak audio output, runs on 3-15 volts, uses 3-45 ohm speaker.

Complete kit, SM-3
$2.95

SUPER SLEUTH
A super sensitive amplifier which will pick up a pin drop at 15 feet! Great for monitoring baby's room or as general purpose amplifier. Full 2W rms output, runs on 6 to 15 volts, uses 8-45 ohm speaker.

BN-9 Kit **$5.95**

60 Hz TIME BASE
Runs on 5-15 VDC.
Low current (25ma)
1 min/month accuracy

TB-6 Kit **$5.50**
TB-6 Assy. **$9.95**

TELEPHONE TRANSMITTER
Low cost with professional performance. Features include; self phone line powered, tunable from 76 to 100 MHz, polarity antisensitive, compact size (½" x 1¼"), easily installs anywhere on the phone line or inside the instrument itself.
PB-1 KIT

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FM RECEIVER
For built-in applications or hobby experimentation. Full fledged superhetrodyne receiver, microvolt sensitivity, 10.7 MHz IF, Integrated Circuit detector, 50 mw audio amplifier, 9V external power source, operation on standard FM broadcast band as well as large portions on each side, compact (6" square), for bug detection or reception

FR-1 KIT **$14.95**

FM MINI MIKE
A super high performance FM wireless mike kit! Transmits a stable signal up to 300 yards with exceptional audio quality by means of its built in electret mike. Kit includes case, mike, on-off switch, antenna, battery and super instructions. This is the finest unit available.

FM-3 Kit **$14.95**
FM-3 Wired and Tested

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–34

1986 40-METER WORLD SSB CHAMPIONSHIP

Callsign, QTH, QSOs, states and provinces, DX countries, total score
** = World Champions; * = State, Province, Country Champions

W/VE—Single Operator:

** N5AU	TX	1,397	56	32	641,080
* KE5CV	TX	1,261	56	37	626,355
KE5IV	TX	1,151	56	30	530,620
* K6HNZ	CA	737	55	21	319,960
* KQ1F	MA	839	55	14	292,215
NR5M	TX	674	55	23	281,190
* NC2V	NJ	782	51	12	251,055
K1KJT	MA	667	54	14	230,180
* KV0I	NE	748	56	4	225,600
* NJ8N	WV	666	54	13	225,455
W6MKB	CA	380	47	31	190,320
N2BOW	NJ	516	53	17	185,150
N6ADI	CA	366	52	26	169,650
* WI4R	GA	515	54	11	168,675
* N4EJV	FL	418	48	22	154,350
* KA7DLV	MN	462	52	4	129,640
* AC3T	DE	407	50	10	123,300
* WD4KXB	VA	382	51	12	122,220
W4WKQ	FL	439	49	5	119,340
* NE8T	MI	389	49	8	112,005
WA2HFI	MN	410	51	2	108,650
* VE3BVD	ONT	322	42	18	106,200
WA2YLY	NJ	360	45	4	88,445
* KA1SR	RI	301	43	10	80,030
* W4TMR	NC	259	46	13	79,650
* K3ZO	MD	262	42	11	72,610
* KD0HY	AR	268	45	5	68,000
* VE1NG	NS	190	43	21	65,280
* KC4TX	KY	200	47	12	63,425
K5FUV	AR	203	41	11	54,340
* W3ARK	PA	242	43	1	53,240
WA6FGV	CA	217	45	3	52,320
K5HSL	TX	200	43	5	49,920
K5GN	TX	204	45	2	48,175
* N0BSA	CO	187	44	6	47,250
* KE7KF	UT	230	34	5	46,215
* W3SOH	VT	216	40	2	45,360
* N4HQT	TN	239	36	0	43,020
* KA2VAJ	NY	214	38	2	42,800
* KQ9Z	IN	205	37	3	41,200
* KN1M	ME	155	38	6	34,760
KI4UJ	KY	138	38	4	29,610
KF4HK	NC	106	37	5	22,680
* KB8KW	WY	102	39	4	22,575
* KA9BQA	IL	122	36	1	22,570
W0NGB	MN	104	42	1	22,360
K5ZD	MA	93	33	8	20,090
* W1WEF	CT	100	38	1	19,695
K8KUH	MI	94	34	3	17,575
W3RGX	MD	88	37	2	17,355
* W9MQZ	WI	103	33	0	16,995
KC7PA	UT	101	26	4	15,600
K4GKV	GA	81	31	5	15,120
WA5IYX	TX	76	36	2	14,630
* KA7STQ	OR	100	26	2	14,100
WK4F	FL	71	33	3	13,320
W9REC	IL	61	33	0	10,065
W8VEN	WV	64	29	1	9,600
K7LXC	WA	63	30	0	9,450
NE6I	CA	73	21	3	8,880
VE6CPP	ALB	63	26	0	8,190
N5AFV	TX	55	26	2	7,840
KF1B	CT	52	25	2	7,020
KD5SA	TX	32	19	0	3,040
VE7BBD	BC	31	18	1	2,945
VY1CW	YUK	26	10	2	1,860
K2SCU	TX	20	11	5	1,840
WA3JXW	PA	15	10	0	750
K1NCD	CT	14	9	0	630
W3FQE	MD	3	3	0	45

(Checklog: K6FM.)

DX—Single Operator:

** ZS6BPL	South Africa	400	44	43	340,605
* I4RYC	Italy	366	36	51	270,570
* DJ3HJ	West Germany	227	7	53	91,800
* HC1OT	Ecuador	141	32	22	74,790
4M5J	Venezuela	91	25	19	36,520
* YC0DPO	Indonesia	192	0	19	34,580
KH6DW	Hawaii	74	27	11	27,170
JR6EZE	Japan	69	2	25	15,525
SP9FIH	Poland	55	0	20	6,100
Y43GO	East Germany	56	0	19	5,320
Y24MB	East Germany	52	0	18	4,770
Y54NL	East Germany	54	0	17	4,675
* HL1ABR	Korea	128	1	6	4,585
OK1KZ	Czechoslovakia	55	0	15	4,200
OZ1DPW	Denmark	36	0	14	2,590
LZ2QV	Bulgaria	36	0	13	2,535
Y78XL	East Germany	27	0	14	1,540
OK1AJN	Czechoslovakia	25	0	11	1,485
Y36NC	East Germany	27	0	10	1,350
JA1YAG	Japan	17	3	5	1,280
I4CSP	Italy	17	0	17	1,235
EA3ALM	Spain	21	0	10	1,150
EA3BOX	Spain	17	0	9	765
OK3YK	Czechoslovakia	19	0	8	760
YU7SF	Yugoslavia	17	0	8	680
Y32KE	East Germany	14	0	9	675
Y22WF	East Germany	17	0	6	510
JE1GZB	Japan	7	2	2	260
JH3DEJ	Japan	5	0	4	160
OK2BHQ	Czechoslovakia	7	0	4	140
Y34OL	East Germany	7	0	3	105
JA2MNB	Japan	3	0	3	90
OK2ABU	Czechoslovakia	4	0	3	60
JA1KFX	Japan	3	1	1	60
LZ1BJ	Bulgaria	3	0	3	45
Y59ZF	East Germany	3	0	3	45
JR4ISK	Japan	2	0	2	20

(Checklogs: Y32UC, Y38YK, and Y55YF.)

W/VE—Multi-Operator:

** KS9O	IL	1,031	57	23	424,000
* K5LZO	TX	674	55	27	320,620
* NK7U	OR	831	56	19	319,125
* W8RA	MI	718	53	31	317,100
* WA3SPJ	PA	703	53	25	287,820
NT5D	TX	633	50	26	253,080
* NC9F	IL	737	54	12	245,190
K5MR	TX	425	49	19	153,680
* WA6HRH	CA	337	48	16	115,520
* KD5RW	LA	189	41	5	43,930
WV2ZOW	NJ	71	30	3	11,715

DX—Multi-Operator:

** NP4P	Puerto Rico	453	48	28	183,920
* TI2DCR	Costa Rica	169	35	11	39,790
JA3YKC	Japan	67	2	36	26,980
JA9YBA	Japan	53	7	13	10,000
JA0YAK	Japan	32	2	14	4,320
JA2YEF	Japan	23	2	13	3,150
G0AGH	England	29	0	11	1,595

Multi-Operator Participants:

G0AGH	G0AGH, G4XOM, G4IEB
JA2YEF	JI2LPD, JI2QVF, JI2SIC, JJ2VFE, JR2PVI
JA3YKC	JI3ERV, JL3ERV, JR6NWN
JA9YBA	JA9VDA, Mia Takagi
JA0YAK	JH0ELL, JH0USD
NP4P	NP4P, NP4Z
TI2DCR	TI2DCR, TI2KTY
WV2ZOW	WV2ZOW, WB2TIX
WA3SPJ	WA3SPJ, KS3F
K5MR	K5MR, N5RZ
KD5RW	KD5RW, KA5DLM, KA5BOO
K5LZO	K5LZO, KA5SBS, WB5RUS
NT5D	NT5D, WB5N, NM5M
WA6HRH	WA6HRH, KG6JE, N6KUY, N6LJK, KB6JWV
NK7U	NK7U, NI7T
W8RA	W8RA, NF8C
NC9F	NC9F, W9HUW, WB9IPW, W9JB, G4UTB/W9
KS9O	KS9O, NB9T, KA9DVY

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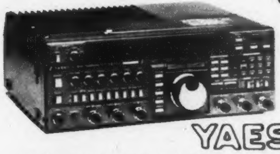

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FT-767GX, FT-980, FT-757GX, FRG-8800
FT-726, FRG-9600, FT-270/770RH, FT-2700RH

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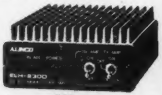

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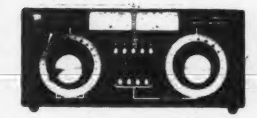

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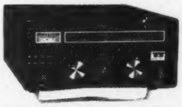

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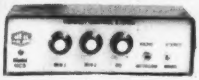

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40-METER SOAPBOX

DJ3HJ	Very strong storm pulled antennas down.
OZ1DPW	First contest I've been in; certainly not my last!
SP9FIH	Pity that I don't have a remote vfo to work split frequency to the USA.
VY1CW	Someday we will have 24 hours of good propagation up here.
N2BOW	Great contest, good scheduling. No football TVI!
NC2V	Poor band conditions + big head cold = low score.
KA2VAJ	Conditions so-so.
WA3SPJ	Never got a European opening.
WD4KXB	Very few DX stations would listen up. Overall an enjoyable contest.
WI4R	First time in the contest. Had a good time though DX conditions were the poorest I have ever seen.
W4TMR	As always, an excellent contest. Looking forward to returning next year.
W4WKQ	A very FB contest!
WA5IYX	Biggest thrill was finally getting a ZS6 on 40 meters.
KA7DLV	I was amazed at all the activity that persisted clear up to the very end of the contest.
K7LXC	50 QSOs in last 20 minutes—whew!
NC9F	About 0600 the power in the neighborhood failed. You can imagine the looks we got from the neighbors. They assumed we caused it.
W9MQZ	Enjoyed the contest very much.
KV0I	First time I finished WAS so early in the contest.

	1982	1983	1984	1985	1986
W/VE Single Op:	VE5DX	KC5NQ	KE5CV	KE5CV	N5AU
W/VE Multi-Op:	N9NB	K3TUP	K3TUP	K3TUP	KS9O
DX Single Op:	YV5ANE	4M3AZC	KD7P/KH2	DJ3HJ	ZS6BPL
DX Multi-Op:	I4YNO	I5NPH	I4KDJ	I4KDJ	NP4P

Table 2. 40-meter world champions.

Single Op:				
N5AU	TX	Unknown at press time		
KE5CV	TX	TS-930S	Alpha 77D	four 3-element yagis
KE5IV	TX	TS-930S	Alpha 77DX	two 4-element yagis
K6HNZ	CA	TS-930S	Alpha 76PA	2-element yagi
ZS6BPL		Home-brew	Home-brew	2-element yagi
Multi-Op:				
KS9O	IL	C-line	SB-220	3-element yagi
K5LZO	TX	TS-430S	Alpha 76A	4-element yagi
NK7U	OR	TS-930S	Alpha 78	4-element yagi
W8RA	MI	TS-180	SB-220	3-element yagi
WA3SPJ	PA	TS-830	Alpha 76PA	3-element yagi

Table 3. Equipment of the top-five single- and multi-op 40-meter stations.

from this year's entries, showing the antennas used in the 40-meter contest and their percentages:

Inverted vee/dipole	37.5
Vertical	16.5
2-element yagi	11.5
3-element yagi	9.5
4-element yagi	9.5
Miscellaneous wire arrays	5.5
Delta loop	2.5
G5RV	2.5
Rotary dipole	2.5
Half-wave sloper	2.0
Folded umbrella	.5

So how does your station compare? Are you like me, going to add another element next year? Right on. Check out last year's survey. The results are quite similar. For the most part, World Champions run 4-element arrays, while state or provincial winners use dipoles.

Table 3 compares your station to the top five in each category. Let's see what makes a championship station besides a darn good operator.

This year saw some new records established. Glance through Table 1, the honor roll list of 40-meter world-record holders. I'm sure you'll recognize some of the stations listed. Perhaps next year, your call will lead the list for your state, province, or country. Plan your attack and go for it!

On behalf of 40-meter Contest Chairman Dennis Younker NE6I: Thank you all for your dedication to the band and for the support given our events year after year. A standing ovation to our four World 40-Meter Champions: N5AU, KS9O, ZS6BPL, and NP4P. ■

Look for the 20- and 15-Meter World Championship results in the February issue.

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- *9 Volts Battery Operation Power Source and Power On Indicator by LED Display*
- *External Power Jack* Size: 79(W) x 30(H) x 100(D) mm

Warranty

- *180 Days From Date of Purchase*

Unit Cost

- *$59.94 plus $4.00 Shipping and Handling Charge*

SPECIAL EVENTS

SOUTH BEND IN
JAN 4

A Hamfest Swap 'N' Shop will be held on January 4 at Century Center, downtown on U.S. 33, oneway, north between the St. Joseph Bank Building and the river, in South Bend, Indiana. Four-lane highway to the door from all directions. Tables: $5/5-foot round, $10/8 x 2.5 rectangular, $2/ft. wall locations. Talk-in on .52, .99/.39, .93/.33, .69/.09, 142.29. For more information, contact Wayne Werts K9IXU, 1889 Riverside Drive, South Bend IN 46616; (219)-233-5307.

MILWAUKEE WI
JAN 10

The West Allis ARC will sponsor the 15th annual Mid-Winter Swapfest on January 10, from 8 a.m. to 3 p.m., at the Waukesha Co. Expo Center Forum. Directions: I-94 to Co. J, south to FT, west to expo. Admission is $2 in advance, $3 at the door. Tables (4-foot): $3 in advance, $4 at the door. Advance deadline is January 2. Amateur exams given. For tickets or information, write to WARAC Swapfest, PO Box 1072, Milwaukee WI 53201 (SASE please).

ROBERT E. LEE'S B'DAY
JAN 17–18

The Confederate Signal Association of South Mississippi will operate a special-event station on January 17–18 to celebrate Robert E. Lee's birthday. Operation times will be 1800 UTC Saturday to 1900 UTC Sunday. The frequencies planned are 21.150, 21.350, 28.150, 28.350, 50.150, 144.150, and 432.150. QSL via W. R. Jeffrey KA4CRT, PO Box 923, Gulfport MS 39502-0923.

HOSARC DOUBLE 7
JAN 18

The Hall of Science ARC will issue a commemorative certificate to anyone working a HOSARC station on January 18, in celebration of its 14th anniversary. HOSARC stations using the call WB2JSM will operate SSB in the 40- and 20-meter General phone bands, and CW in the 40- and 15-meter Novice bands, from 1500 to 2100 UTC. QSL with a large SASE (44¢ or one IRC) to: HOSARC QSL Manager, Arnie Schiffman WB2YXB, 81-22 250th Street, Bellrose NY 11426.

MICHIGAN 150TH
JAN 25

The Oakland County ARS will operate W8TNO on January 25, from 1600 to 0000 UTC, to celebrate the 150th anniversary of the state of Michigan. Operation will be on 20 through 80 meters, SSB and CW. Suggested frequencies are 14.270, 7.270, and 3.870; CW—7.130 and 3.730. For a special certificate, send a 9 x 12 SASE to W8TNO.

YONKERS NY
JAN 25

The Yonkers ARC will sponsor its Electronics Auction on January 25, from 9 a.m. to 3 p.m., at Lemko Hall, 556 Yonkers Avenue, Yonkers, New York. Inspection from 9–10 a.m.; auction starts at 10 a.m. sharp. Admission is $3, children under 8 free. Club commission on successful sales only: 10% on first $100, 5% on remainder. Talk-in on 146.865, 440.150, or 146.52. For more information, contact YARC, 53 Hayward Avenue, Yonkers NY 10704; (914)-969-1053.

GREENVILLE AL
JAN 25

The Butler County ARC will hold its annual Hamfest on January 25, from 8 a.m. until 2 p.m., at the Greenville, Alabama, Recreation Center.

SOUTHFIELD MI
JAN 25

The Southfield High School ARC is sponsoring its 20th annual Swap and Shop on January 25, from 8 a.m. to 3 p.m., at Southfield High School. Admission is $3. Reserved tables are $20 for two 8-foot tables (paid in advance). Additional reserved tables are $10 each. Tables will also be available at the door. Please reserve tables and tickets in advance and specify if you need electrical outlets and wall space. All table reservations will be confirmed. For more information or reservations, write to Robert Younker, Southfield High School, 24675 Lahser, Southfield MI 48034.

MARSHALL ISLANDS
JAN 31–FEB 9

The Kwajalein ARC will operate KX6BU from 0600 UTC January 31 until 0600 UTC February 9 to commemorate the 43rd anniversary of the Battle of Kwajalein and Roi-Namur. Frequencies: SSB—14.250, 21.350, 28.550; CW—7.025, 14.050, 28.050. For $6, KX6BU will issue a QSL, certificate, and a 64-page book on the battles of Kwajalein and Roi-Namur. Three dollars will bring the QSL and certificate. Send all requests to KX6BU, Box 444, APO San Francisco 96555-0008.

CLARK GABLE BIRTHPLACE
FEB 1

The Harrison ARC will operate special-event station N8TF on February 1 from the birthplace of Clark Gable. SSB operation will be on approximately 3.875 and 7.230 MHz from 1400–2200 UTC. For a special QSL, send QSL and SASE to KC8XS, PO Box 362, Cadiz OH 43907.

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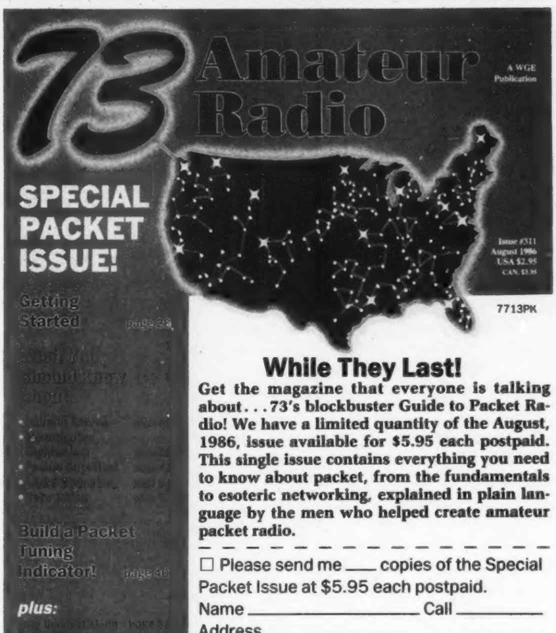

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RADIO LAN

This month I had planned to talk about approaches to the design of timebases for the satellite station. With the first three columns safely on disk and off to *73*, I headed west for a month of geological fieldwork, confidently assuming I would start column #4 (this one) on my return. Instead, what awaited me on my return was a very disturbing letter from Richard Barth W3HWN of the Office of Radio Frequency Management at NOAA. The problem posed in this letter was serious enough to follow up with a phone call, and that in turn has led to the redirection of this month's column. The discussion of timebases can easily wait another month, while the subject this time around will not!

The problem relates to the possibility of a new radio service that has the potential to cause severe interference problems in the 1700–1710-MHz satellite band! Prior to the description of the problem, let's begin with some background as to why this particular piece of rf "real estate" need concern us.

Anyone interested in weather satellites is familiar with the TIROS/NOAA polar-orbit satellites, if only because the APT (automatic picture transmission) images transmitted on VHF by these spacecraft are among the easiest to receive and hence tend to be the first target of aspiring weather satellite enthusiasts. In the "old days," which in the case of weather satellites means the late 60s through early 70s, the APT images transmitted by polar orbiters were the *only* images transmitted by operational spacecraft. With the arrival of the first ITOS satellites, which served as the early operational NOAA spacecraft through the middle 70s, scanning radiometers replaced vidicon cameras as the primary imaging instruments.

The ITOS spacecraft had two radiometer systems, one operating at relatively low resolution to provide direct broadcast APT and another, the very high resolution radiometer (VHRR), providing high-resolution, multi-spectral imagery for reception by government ground stations. With the advent of the TIROS-N spacecraft, the basic bus for all current spacecraft in the NOAA series, the two classes of radiometer have been replaced by a single model—the advanced very high resolution radiometer (AVHRR)—capable of producing multi-spectral imagery of extremely high resolution, and it is the high-resolution picture-transmission (HRPT) signal that is the primary imaging service from these spacecraft.

The HRPT signal is digital in nature and carries information from two visible and several IR spectral bands, transmitted at extremely high bit rates using phase modulation in the 1700–1710-MHz band. The lower-resolution APT signal is derived by digitally sampling the HRPT data stream, permitting correction for panoramic distortion in the APT signal output. The visible APT channel represents data from one of the two HRPT visible spectral bands, while the IR APT output is derived from one of the many IR channels of the HRPT data stream. Since the APT image data represents only a fraction of the original HRPT data, the APT images have far lower resolution than the original HRPT image, but this is the price to be paid to have the simplicity of AM modulation of a simple subcarrier and the use of simple, relatively narrow bandwidth FM receivers!

The technical problems involved in setting up an HRPT station are immense, and it was never envisioned that any more than a few government ground stations would be used. The problems include the following:

1) Antennas. The HRPT signal is low-powered (about 5 Watts) but operates at a wide bandwidth, resulting in the need for high-gain antennas and low-noise preamps. The high-gain antennas (dish, multiple-helix arrays, or whatever) have a correspondingly narrow beamwidth, and thus the antenna must be tracked with extreme accuracy during a polar-orbit pass.

2) Receivers. The HRPT receiver, exclusive of the low-noise S-band front end already noted, must have a wide bandwidth (relative to APT) and a digital detector for data demodulation. Gain margins are quite small so the bandwidth must closely match that of the signal, and this leads to problems with Doppler shift. Doppler shift is proportional to the operating frequency so, while it is only a few kHz at VHF, it is several tens of kHz at S-band! Ideally, to minimize noise effects, the receiver must match the bandwidth of the transmitted signal and incorporate afc to "track" the signal frequency during a pass.

3) Display. This is an area that presents many challenges since the multi-spectral images have inherently greater resolution than most common display devices. Problems include developing software to: lock onto the HRPT data stream, decode the data, store as much of it as possible, and sample portions of the data set with an intensity proportional to the resolution capabilities of the display system. Computer power and mass data storage are the keys.

Technology does not stand still. The steady fall in price of commercial HRPT systems coincident with an increase in amateur capabilities has led us to the point where there are more than 120 known HRPT stations, a number of which have been constructed by "amateurs." The amazing leaps in rf and microcomputer technology, including the arrival of GaAsFET preamps and the power inherent in AT-level microcomputers, mean that HRPT capability will continue to become more affordable and hence more within the reach of the "typical" amateur. It was only about 10 years ago that WEFAX capability on S-band was considered out of reach of amateurs. Today it is almost as easy to set up a WEFAX station as it is to build an APT system. It is reasonable to expect HRPT capability to follow a similar track. The prize is worth the effort, as examination of this month's picture of the month will indicate!

Date	1 January 1987		
Spacecraft	NOAA-6	NOAA-9	NOAA-10
Orbit Number	39061	10574	1498
Eq. Crossing Time (UTC)	0133.43	0032.85	0012.79
Longitude			
Asc. Node (Deg. W.)	107.19	144.08	70.51
Nodal Period (Min.)	101.1277	102.0851	101.2979
Frequency (MHz)	137.50	137.62	137.50

These orbital parameters are projected two months in advance due to deadline considerations. Accumulated errors due to uncompensated orbital decay and other anomalies result in expectation of errors up to two minutes and possibly as many degrees in terms of the crossing data and possible small changes in the indicated period. Users requiring precision tracking data should rely on more current sources.

Table 1. TIROS/NOAA orbital predict data.

All of this rambling constitutes the "good news"—now for the bad. The same rf and computer technology that is bringing HRPT closer to the "masses" has other implications as well. If you are at all familiar with computers, you have probably run into the acronym LAN, which stands for local area network. A LAN involves interconnecting a number of microcomputers to each other and often to a central mini or mainframe unit. Such systems are extremely powerful since machines in the system can share files, programs, and computing power, and LANs are definitely "in" in business and scientific enterprises.

If a LAN is to be effective, the micros in the system must exchange data at very high speed and this leads to the only drawback of a LAN system—the need to interconnect all components of the system with wide-bandwidth coaxial cable or fiber-optic links. The need for this wide-bandwidth physical connection makes it difficult to re-site individual units, so Motorola has come up with an interesting new approach known as "Radio LAN." Instead of a physical link between LAN components, Radio LAN proposes a wideband rf link, making it far easier to move components of the system around a complex as changing needs dictate.

While this is marvelous in concept, it is the implementation that has the potential to be disastrous. In its Radio LAN proposal to the FCC, Motorola requested the use of the 1700–1710-MHz band for this system. Citing very few HRPT stations, they felt that such a system could be implemented by simply avoiding existing HRPT station locations.

The problem, of course, is far more complex. First we actually have far more HRPT stations than previously suspected, and many of these will be difficult to locate as there has been no need to register the existence of such installations. Although the pro-"Radio LAN" forces see the number of such stations as relatively stable, the experience with WEFAX indicates that the numbers could rise dramatically as technological advances continue and the cost of installation falls. Imagine your local 1700-MHz noise floor in a few years if you set up an HRPT system, only to discover that a local business, university, or other agency is passing around data on an rf LAN! Ditto for an existing installation whose location is unknown, causing the installation of a local 1700-MHz noise generator.

The impact on WEFAX operations (1691 MHz) is uncertain; it all depends on the frequency stability of the LAN rf sources and their proximity. You may very well need rf pre-filters to avoid desensing, and these will degrade your system noise floor. Each and every one of the hundreds of existing WEFAX stations also represents the nucleus of a future HRPT installation since antennas and rf capability are already in place!

If this were not bad enough, the FCC, in replying to the Radio LAN proposal, responded with a notice of proposed rule making (NPRM) that was far broader than the initial LAN proposal, leading some to suggest that it was now "open season" on the 1700-MHz band! By raising the possibility of remote rf digital links, the industry is buzzing with ideas on what could be accomplished if only the erp limits could be raised by a "mere" 10 dB or so!

The inherent mobility of Radio LAN units presents very real difficulties even if we consider only existing HRPT installations. Their very existence may very well propose a fatal inhibition on the development of new installations. Expansion of the 1700-MHz rf data-link concept represents the potential of insupportable rf pollution of this particular window into space. An rf link between space and ground is an absolute necessity, but this important link may well be drowned out by thousands of computer and other digital rf links that are simply a convenience compared with the hard-wired alternative.

An old VHRR shot from the earlier NOAA series. This particular picture has the Gulf of St. Lawrence in the lower right, complete with ice cover and a bit of Anticosti Island. All the interior lakes in Quebec and the northern Gaspe Peninsula are snow and ice covered. The circular feature in interior Quebec is Lake Manicouagan. The HRPT images are even better, with higher resolution and obtained at a lower altitude.

Our alternatives are remarkably limited at present. The comment period on the FCC NPRM has passed and the fate of the proposal is unknown. If the Federal wheels grind slowly enough, we may gain some leverage in decision making by means of the second alternative—the registration of HRPT stations. Such a registration was the subject of Mr. Barth's letter that generated this particular column. In effect, he was attempting to locate operational HRPT stations and those in the "serious planning" stage. NOAA is willing to register such stations at no charge and with no obligation, provided they can be located. Registration of your installation requires that you furnish the following information:

1) Latitude and longitude of the station to the nearest minute.

2) The name and address of the person or organization operating the station.

3) The name, address, and phone number of a contact person in case further information is necessary.

This information should be forwarded to: Office of Radio Frequency Management, Room 6106, Main Commerce Building, Washington DC 20230. If you have questions or need more information, contact Mr. Richard Barth at (202)-377-0635.

Registration of your station can have two possible effects. The first is direct. Should Radio LAN or other such systems be approved, registration will inhibit siting of such a system close enough to your installation to cause harmful interference. In essence, registration will protect your *present* station location(s). The second effect of registration may be even more significant. If the number of registrants rises high enough to present a significant administrative burden, the FCC may opt to look at alternatives to the 1700–1710-MHz band and that would bode well for the future!

There is little question about registering an operating HRPT station—you had better do it! But what constitutes enough "serious planning" to register a system that is not yet operational? This is a judgment call for each individual, but let me suggest a few operational guidelines for your consideration. *Any* existing or upcoming WEFAX installation can receive in the 1700–1710-MHz range in question by simply tuning the i-f to the 146.5 to 156.5 MHz range, assuming the standard 137.5-MHz i-f for 1691-MHz WEFAX. I cannot assume how you might wish to use or experiment with such a signal, but if you are equipped and wish to do so, your reception capability deserves protection since the meteorological satellite link is primary in this band. Give it some thought!

New TIROS in Orbit

As this is being written NASA has broken its hard-luck streak and succeeded in launching a new TIROS spacecraft from Vandenburg. The spacecraft successfully reached orbit and preliminary indications look very good. Checkout of HRPT and APT imaging systems will begin shortly. Assuming all goes well, this spacecraft will become NOAA-10 and will serve as the replacement for NOAA-6, becoming the operational "morning spacecraft" on 137.50 MHz. Given the nature of the deadlines for column text and predict data, you will already have seen this change reflected in the December predict listings, in which NOAA-10 replaced NOAA-6.

Satellite Bulletin Board

Those of you with computers, modems, and communications software should look into a useful and well-run bulletin board service (BBS) provided by Jeff Wallach N5ITU. This board (214-340-5850) operates 24 hours a day at 300/1200 baud with 8 data bits, no parity, and 1 stop bit. This is a free, open-access service supported by Jeff and a number of other talented folks devoted to providing current information on both manned and unmanned spacecraft. Up-to-the-minute spacecraft status bulletins are provided, as well as bulletins containing the Keplerian elements for a wide variety of satellites, including NOAA and METEOR/COSMOS spacecraft.

The system also provides a comprehensive electronic message system. I check into it about twice each week to pick up and leave messages related to weather satellites. Jeff has been kind enough to offer the use of his system for message traffic between me and my readers, and those of you with message traffic may want to use this option. Turnaround time on messages should be dramatically shorter than using the mail, so if you have ideas or input for the column or reasonably short questions, leaving me a message on the system would be a very effective way to get my attention. I erase all messages to me once they have been successfully downloaded, so if your message number disappears from the current message directory, you will know I got it and you can start looking for a reply.

As a service to all, I am posting an open message at the beginning of each month entitled APT PREDICT. This message will contain reference crossing data for the month in the same format used for this column. While the column predicts must be projected two months in advance, the monthly data in the open message will be absolutely current and thus will avoid the inevitable inaccuracies that are unavoidable when you make long-term predictions for spacecraft in relatively low orbits.

Color Computer 3

The big event for me this month was the fact that I finally got my hands on the long-awaited CoCo 3! This beauty comes stock with 128K of RAM (compared to 64K in the CoCo 2) for $219, and a RAM upgrade board is available for $150 that will take it up to 512K bytes!

The new CoCo runs my Version 3 software for the *WSH* scan converter with no problems, providing full-frame automatic WEFAX, NOAA APT, and both 240-lpm and 120-lpm display in a 256 x 256 format with 16 grayscale shades. Version 4 is in the works now and will probably be ready by the time this appears.

When the program pack is plugged into a CoCo 1, 2, or 3 with 128K, all of the present functions will be available. The real fun will occur if the program detects the 512K RAM in a CoCo 3! In that case, the system will load an image to the CoCo memory with 1,024 pixels/line with 768 lines! Although the system will still default to the transfer of a full-frame image to the 256 x 256 display, if you choose to freeze the image, you will have a whole new set of high-resolution display options based on the recovery of portions of the highly detailed image in memory.

Six medium-resolution quadrants will be available (each representing approximately 1/3 of the total image area at about 1/2 resolution) or a total of 12 high-resolution quadrants can be displayed. This latter option includes every line with horizontal resolution that pushes the theoretical limits imposed by the 2,400-Hz video subcarrier.

Since the original very high resolution image is loaded directly to memory as the picture is received, you can explore the entire image at any resolution you desire! The pictures are truly mind-blowing in detail, either from WEFAX or the polar orbiters, and all of it requires just $369 in computer hardware and the less-than-$100 *WSH* display! I'll keep you posted.

Picture of the Month

Since this column was unexpectedly diverted to the subject of HRPT, this month's picture is included as a "teaser" to indicate the mind-blowing resolution attainable with an HRPT installation. The problem was that I had given away my last HRPT sample. Given the deadlines, I opted for an old VHRR shot from the earlier NOAA series.

This particular picture has the Gulf of St. Lawrence in the lower right, complete with ice cover and a bit of Anticosti Island. All the interior lakes in Quebec and the northern Gaspe Peninsula are snow and ice covered. The circular feature in interior Quebec is Lake Manicouagan—possibly an ancient meteoric impact feature.

To give a sense of scale, this feature is approximately 45 miles across. This segment represents only a small part of the original image. The HRPT images are even better, with higher resolution and obtained at a lower altitude.

Note

References to *WSH* refer to the Third Edition of the *Weather Satellite Handbook*, available directly from the author at the address at the beginning of this column, for $12.50 plus $1 shipping and handling in the U.S. and $2 elsewhere.■

FUN!

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THE FUNKER FOLLIES

Have you ever sat down and thought about the "worsts" in your life?

Perhaps it was the time you upchucked over Mary Sue Pennypacker at the high school prom (a first brush with rye whiskey can do that to a guy). Or maybe it was the time you opened that envelope from the FCC containing your virgin Novice call. Remember how you felt when you first realized that you would be sending CQs with KA0OOO at 5 wpm until you could upgrade? Or perhaps it was the time you were installing your tribander and you dropped the wrench into the windshield of your new Corvette? Ah, memories.

For me, the ultimate, worst, all-time, crummy, most rotten experience was my first job. It was with a company in the ham radio business, which should tell you something right off the bat.

Now, for most of you, getting a job with a ham radio company probably sounds like a dream come true. All you do every day is sit down at your desk and work DX on 20, right? Sure. And magazine writers live in Park Avenue penthouses. (Some writers may actually live in such abodes, but certainly not those who toil for ham radio magazines.)

This job, which was with a company that made hand-held microphones, sucked coax. Yes, it sounded good when, in response to my resume, the company president called to describe the position to me. "You'll be our advertising manager," he said. But little did I know that being advertising manager of a company with approximately $100,000 in gross yearly sales wasn't exactly the same as being head of promotion for General Motors.

I'll admit my qualifications for the job weren't exactly outstanding, either. (I was a recent college grad with absolutely no work experience.) But at $8,000 per year, my boss was getting a steal (even in 1979, I was undoubtedly the lowest paid advertising manager in the United States). I mean, how many companies can ever say they had Mr. Fun! in charge of their advertising program?

The first problem was my boss, a Mr. Ronald T. Funker Jr. Now, Funker Mikes was a funny outfit because Funker Jr., president of the firm, was and wasn't my boss. The real head of the outfit, if you took the time to scratch beneath the letterhead, was Ronald T. Funker Sr.—Funker the First or Funker the Futz, as his employees called him.

Funker the First founded the firm in the 50s. Funker Mikes ran ads in *QST* that showed a little man lifting a big microphone on his knee. The ads made no sense, but you may remember them and they made the company a lot of money.

Anyway, through an intra-family squabble that was a Grade Z version of television's "Dynasty," Funker Jr. had wrested control of the mighty mike conglomerate away from Funker the First. As a result, the first Funker had a big ceremonial office in which he sat (in a funk) doing little except sharpening his vengeance toward Funker Jr.

Funker Sr. would show his animosity toward Funker Jr. in the most humorous and witty ways, like calling him "stupid." Funker Jr., on the other hand, was even more subtle. He would place a rancid onion inside the ceremonial microphone on Sr.'s desk or loosen the bolts on his father's chair so he would strike his head against the wall whenever he sat down. There wasn't much of what you would call love between the Funkers.

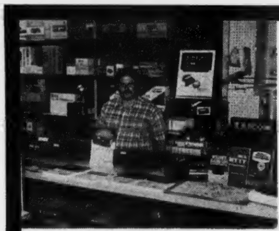
As I mentioned, Funker Jr. was the Funker who hired me. Therefore, ipso facto, Funker the First hated my guts. I initially sensed this when the old man refused to shake my hand. But Funker Jr. told me not to worry, calling his father a "crazy old coot," and said I should get to work.

Sage advice. The only problem was that there was no work. The Great CB Boom was dying out and the microphone market was in a sort of depression (in the same sense that a Cray supercomputer is sort of a micro). In short, Funker Mikes wasn't selling many of its namesakes. (Microphones, that is, not Funkers. Although selling some of the Funker clan might not have been a bad idea, either.)

At any rate, Funker Mikes sold only to the ham community. The elder Funker refused to market any of his products to military or commercial users. I don't think he had any reason for this not-so-shrewd marketing move; it was just that it probably never occurred to him that anyone but hams used hand-held microphones. Go figure it.

Funker Jr. permitted me to run ads in only three ham publications. I won't name the periodicals, but you can probably guess most of the titles, since there were only about four or five ham titles on the market at that time. (Hint:

✓153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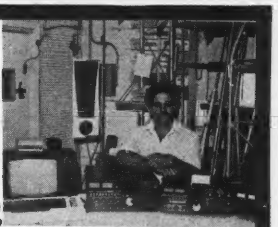
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The TNC-220 is a new, low-cost Packet Terminal Node Controller evolved from the Pac-Comm TNC-200 (TAPR TNC-2). It uses more large scale integrated circuits and fewer components to provide greater functionality, reliability and sensitivity with reduced size and cost. The single-chip modem used for both 300 baud HF and 1200 baud VHF operation has two radio ports. Switching between ports is done entirely in software and no cable changing, no switch setting and no retuning is required! The HF port has an active bandpass filter and provides either FSK or AFSK keying. An optional tuning indicator slides inside the cabinet. A standard modem disconnect header will connect accessory high-speed or satellite modems.

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- Tuning indicator option
- 12 volt DC operation
- Premium quality case
- 6" w x 2" h x 7" d

The TNC-220 has the familiar TAPR command set and AX.25 Level 2 Version 2 protocol running on a Z-80 processor with 32k bytes of EPROM and 16k bytes of battery-backed RAM. A Zilog 8530 SCC performs all packet HDLC in hardware. The terminal port can select either RS-232 or TTL for your C-64/128, VIC-20 or other TTL computer. Five large, color-coded LED's clearly indicate status at a glance. The power switch is now located on the front panel. The TNC-220 is enclosed in a rugged extruded aluminum cabinet with an attractive two-tone blue front panel. All indicators and controls have large, clear labels.

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Two of the magazines had titles with seemingly random letters of the alphabet and the other used a number for its title.)

Now, you might think this sounds like pretty easy work. I mean, running the same ads in three magazines doesn't sound like the toughest full-time job on the face of the earth. And it wasn't. As it turned out, things were extremely easy. Too easy, in fact. Too stupefyingly boring easy. Day after day, I would trudge to my desk, open a notebook, and try to look busy.

Have you ever tried to look busy when you had absolutely no work to do? It's not as easy as it sounds. After all, there are only so many pencils to sharpen, so many drawers to arrange, and so many paper airplanes to throw.

After a few weeks, I began to long for work—real work. Sitting at my desk, eyes blankly fixed on a copy of a ham magazine, I would dream of meaningful labor. I longed to write reports, to attend business meetings, to get yelled at by a boss. After a while, things got even more desperate. I began to think of myself doing work I never would have contemplated in the past. I wanted to be a window washer, or a fellow who painted suspension bridges, or the guy who replaces the light bulbs on top of broadcast towers. I even wanted to drive a New York City taxi! Arrrgh!

Meanwhile, Funker Mikes was failing, and there was nothing I could do to stop the company's inexorable slide into oblivion. Funker was yelling at Funker, and I was responsible for placing ads in three magazines. I had to regularly pinch myself to be sure I wasn't in some sort of Ham Hell. (Please, dear God, I'll never forge another DX QSL.)

Then, slowly, like a landscape appearing before my eyes, the truth revealed itself to me. I, John Edwards, was a pawn in a chess game. And not even a fancy chess game, with Civil War characters sold by the Franklin Mint. I was the pawn in a chess game with plastic pieces from a five-and-dime store.

The truth, in all of its horrifying glory, was that Funker Jr. was using me to get back at Funker Sr. It didn't make any difference whether or not my job ever made a damn cent for the company. I was there out of pure and simple spite. Funker Sr. didn't have the nerve, will, or power to fire me, and Funker Jr. was going to keep me in my stupid job, paying me 8,000 crummy bucks a year, until either the world or Funker Mikes came to an end. I was a capitalist tool!

That evening, I quickly drove home to my one-bedroom apartment. After gulping down a quick snack, I threw all of my meager possessions into a suitcase and drove to my mother's home about 300 miles away for R&R. Funker Jr. never called me, and my best memory of the whole experience was seeing the Funker Mikes sign slowly growing smaller and dimmer in my car's rear-view mirror.■

ATV

Number 14 on your Feedback card

Mike Stone WB0QCD
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CAMERAS AND VCRs

My first three columns took you step by step through the basics of amateur TV. This month, let's talk about a subject that this column hasn't touched upon much: cameras and VCRs. One of the big problems in getting on ATV is the expense of a good camera. To get a good, small, lightweight, full-color camera a few years ago, you had to take out a bank loan to finance it.

But have you checked out the prices today? VCR-type color cameras have dropped significantly in retail price since 1985. The market for VCR home video equipment and movie rentals skyrocketed during this period and is still riding high today. A larger market means more fierce competition and lower prices for the consumer.

Today, if you shop around, you can buy a no-frills home VCR recorder for less than $250. Player-only units are even less. A good color camera with a zoom lens and auto everything averages around $400–$600. Oh sure, you can spend a lot more—and most people might want to with all the neat options now available, such as color keyboard graphic generators, timers, clocks, and the like—but you don't have to just to have something nice for ATV.

Keep in mind that such a purchase will most likely be used for recording the growth years of the family just as old 8mm movies used to do. (This is a good approach to use on the XYL to justify stretching the budget.) Many of you already have such equipment, and this expense has already been incurred. Great!

VCR-type cameras and recorders can be interfaced into fast- and slow-scan TV systems very easily. With such gear, you are halfway to getting active on the mode.

What if this type of purchase, though, is a bit too heavy for the beginning ATVer? At hamfests there are tables full of surplus industrial-type closed-circuit security black-and-white cameras for $30–$90? They will work just fine. You can go to any major hamfest these days and see good deals on used camera and VCR equipment. Some come with lenses, some without.

Cameras are scary to buy sight unseen. My best method is to look closely at the unit. Is it scratched or dented, or does it have dangling broken parts? Is the lens cracked? Does the viewfinder TV screen work? Talk to the seller and get him to say whether or not this camera really works. (Flea marketeers don't lie, do they?) Ask him if there are any burn marks or spots on the camera tube itself. Then watch his eyes on the big question: Let's go inside, hook this camera up to a monitor and 110 V ac, and give it a try, OK? If he starts doing the backstroke or says he is too busy working at his table, beware.

If you do get stuck, most replacement camera tubes are not all that expensive. A good source of used and new tubes (and good working cameras, for that matter) is Mel Shadbolt W0KYQ at ATV Research, 1305 Broadway, Dakota City NE 68731. Mel actually began the former *A5* Magazine with the help of Wayne Green and *73* many years ago. He is a respected ham and will help you with whatever you need.

An old discarded black-and-white camera picked up for $10 in non-working condition can sometimes be revitalized for little cost. The classified advertising section in *The SPEC-COM Journal* often has such bargains, too. Sometimes, big hefty studio-type cameras that work are sold or given away. Most people want small, lightweight units. If you have the room for a CBS-3, which weighs more than your mother-in-law, go for it. Won't the neighbors be impressed?

Interfacing Video Equipment

The camera and VCR plug directly into fast- and slow-scan TV converters. You might encounter some uncommon connector problems, but they can be easily overcome. Most slow-scan converters use BNCs for camera inputs. Radio Shack has all kinds of adapters to get you down to a BNC male. Fast-scan TV transceivers use either SO-239s, RCAs, or BNCs. Video cables should be 75 Ohms.

Length is not critical for the ham shack if you want to mount your camera up close to the ceiling in a nearby corner and run a length of cable over to your rig. Some will get a tripod to put it on, while others will just rest it on a pile of old *73*s. Be sure and hide the wires so that the kids and XYL don't trip over them, making the rest of us watch pictures resembling a helicopter out of control.

There are video level brightness and contrast settings on the FSTV/SSTV rigs, so don't worry if you don't see anything like that on the camera itself.

VCRs are really nifty once interfaced on ATV. They can be fed an ATV signal one of two ways: *direct*—ATV downconverter CH.3 or sampled video outputs right into the VCR or *indirect*—by simply pointing the camera on the TV set. The direct method seems to work best for stronger signals and presents a full-screen image on the replay. On weaker or sync-unstable signals, filming right off "the tube" works best, especially on DXing. To send someone your best pictures of your shack and then to see them coming back on instant replay is something that's not done in any other amateur mode.

I have nearly six years' worth of videotaped cassettes of ATV QSOs and special events. It is a

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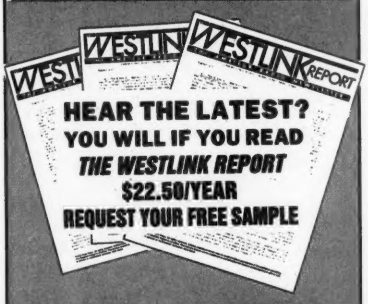

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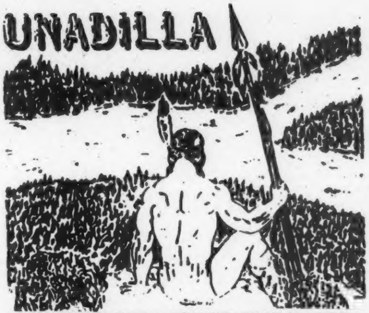

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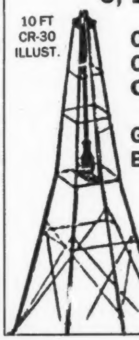

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lot of fun during a cold winter night to replay these tapes to others and "see" how far we all have come in just a few years.

In every group, a member passes away now and then. It is heartwarming to replay videotaped material of that ATV friend now gone. Later on, the families will want a copy, too. I edit most of my tapes and condense them into shorter programs. Most of them have dates and titles. The coming of the VCR has been a big boost to the operating capabilities of the ATV operator in the 80s.

Location

Where is the best place to put your ATV camera? It depends on what you want to show. Some ATV operators like to be flexible with their camera and have it mounted so that they can quickly remove it and hand-hold it on the subject material. It is fun to be able to walk around with your camera in the shack and show different pieces of gear or that latest project that you are building. Others like to fix their camera on a wall mount or tripod so it points down at the operating position. Some like it facing them head on, while others like a backside approach, catching the majority of their equipment in the picture as well. It just depends on your room, the capabilities of your camera, and what you like to show.

Slow-scanners need to have the camera close by for focusing on close-up picture photography. Did you know that color SSTV can be sent from black-and-white cameras? Kodak gelatin red-green-blue filters can be placed in front of the camera lens and "snatched" into three memories for a bright and beautiful full-color picture. That method is fading slowly with the advent of more sophisticated color SSTV equipment, such as the ROBOT 400C, 450C, and 1200C units, which accept color cameras for inputs.

Wide-angle lenses are a near must for the fast-scanner to get the most in the picture. The walls of every ATV shack are lined with CQ-ATV and callsign posters for the camera to focus in on.

Using your camera on ATV is certainly a lot of fun. One night, we all transmitted our shack pictures one by one "upside down" to an individual who was just getting started. The terrible, sneaky plan backfired when he came back on the air a little while later proclaiming that he had simply turned his TV set upside down to compensate for our mischief. . . shucks!

Photo A. Bill Bryant K9KKL of Springfield, Illinois, sends his FSTV picture 110 miles to WB0ZJP in St. Louis, Missouri (100 Watts).

Many ATVers have more than one camera. Some have them spotted all over the place. Controlling is done by manual video switchers or more elaborate automatic "scanning" switchers found in surplus CCTV buy-outs. A few brave souls mount a camera on the roof or on their tower. If you go first-class, you'll put it in a weatherproof box and add a heater, a rotor motor that pans and tilts, and, of course, a windshield wiper in case it rains (and they think I am kidding, Warren W5DFU).

WOWT-TV in Omaha, Nebraska, has an 800-foot tower with TOWERCAM on it, controlled by WB0CMC and the local Omaha ATV repeater crew. Imagine the thrill of tracking bad weather as it passes through the area and seeing the night lights of the city or that blonde beauty sunbathing 17 miles away. Shame on you, John.

Finally, you can feed anything that is video into ATV transmitters—cameras, VCRs, computers, other TV sets, games, and so on. That really opens the door for a wide range of available ATV entertainment.

ATV Repeaters and Remote Transmitters

I promised a few words about ATV repeaters. A few points I touched on in earlier columns should be re-mentioned. It is not uncommon to hear a "new" ATV group (active fewer than two years) start making plans for an ATV repeater right away. That, in my opinion, can be a fatal mistake. Why? Because UHF FSTVers need at least a couple years of self-development at their own stations to get to the point where they have their equipment, cables, antennas, preamps, and the like operating at near full capacity on simplex frequencies.

So what if you live 30 or 40 miles from each other? Making those ATV pictures appear on the other guy's screen is most of the fun. ATV repeaters (like any type of relay device) can discourage self-improvement activities. It is only human nature to become lazy. Simply put, if you get 12 of your best friends to get on UHF FSTV with you and your group puts up an ATV repeater, it is likely that 11 of them won't get out more than 10 miles in the next 20 years. I have seen it happen in so many areas.

Do it on simplex for a while, and once you feel that your group has experienced its share of growing pains; has operated multi-element beam arrays, mast-mounted preamps, and hardline or at least 9913 coaxial cable; and has worked a lot of DX out to several hundred miles (if that is possible in your area), then and only then should you consider an ATV repeater system. Irresponsibly thrown-up repeaters might grab quite a bit of interest in the beginning, but once people start getting hit with simple UHF or video-related problems, interested users will drop like flies.

Polarization May Be Hazardous to Your Health

Repeaters must be placed in the right antenna polarization mode as well, or severe damage to activity levels can occur. In Indianapolis, Indiana; Columbia, South Carolina; Minneapolis and St. Paul, Minnesota; and parts of Kentucky, New York, and Texas, well-intentioned people decided to change from the antenna polarization used for years by ATVers to vertically polarized groundplane antennas on their repeaters.

Immediately, most people changed their antenna polarization to work the repeater. (There is a 20-dB loss factor on cross-polarized signals.) Many promised to have switchable array systems, but never went back to the former mode. Some refused to make the change. Others dropped out of ATV because they did not have the time, ability, or money to make the switch. Those stations out 50–100 miles or more were left in the cold and were forced to change or search elsewhere for contacts.

Careful consideration must be made in this decision. There are now a number of published antenna designs for horizontally polarized omnidirectional antennas *with gain*, and they work well. K4NHN's Rib-Cage Slot antenna, for example, shows a 7-dB gain over a half dipole.

My group's multi-phased KLM 6-element beam array in Davenport, Iowa (N9CAI/R), has been up and working for more than two years now and covers our regional area quite well, both on receive and transmit, for an actual repeater working "circle radius" of more than 100 miles in all directions. All this was done with the ATV repeater and remote transmitter horizontally polarized, and *no one* had to change one element on any antenna.

The majority of the country is horizontally polarized on FSTV. If you live in or near an area that is vertically polarized, then by all means go vertical. The point I am trying to make to you, the newcomer, is to look around, out to several hundred miles, and then determine the antenna polarization that is right for you.

See you next month, and don't forget to send in your Reader Service and Feedback cards. Keep the mail coming and "see you" on the tube.■

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WHAT ELSE DOES IT TAKE TO GET ON ATV?

Any Tech class or higher amateur can get on ATV. If you are now on SSTV, or have a home camera or VCR & TV set, your cost will just be the TC70 and antenna system. If you are working the AMSAT satellites you can use the same 70cm antennas on ATV.

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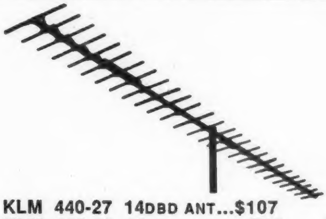

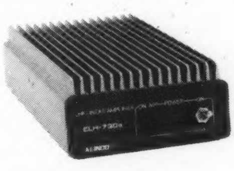

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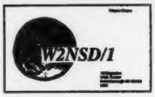

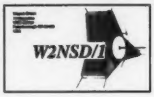

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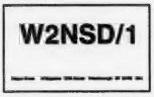

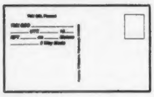

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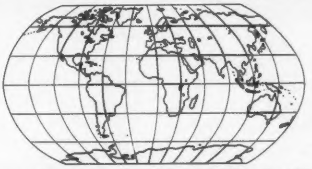

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NK6K>PACKET

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Did you answer the December, 1986, packet poll? If not, you probably still have plenty of time to do so, as I'll most likely procrastinate on tallying up the totals, just as I procrastinated on this column. I have to be on a plane to Boston in nine hours for a trip that will end up at the AMSAT annual meeting in Dallas, and this column has to be in before I go. The AMSAT meeting, with its discussions on the new Phase 4 satellite project will give me enough to talk about for the February column, and I can start on it as soon as I get back, right? Don't be silly.

Good News, Bad News

First, the good news. The FCC has made the waiver to 85-105, which allowed unattended transmission of third-party traffic above 50 MHz, into a permanent part of Part 97—section 97.80(b). The waiver was discussed in my November, 1986, column. Now for the bad news. It still mentions AX.25 by name and makes it the only protocol that can be run unattended to transmit third-party traffic. An excerpt of the FCC ruling follows. It was originated by Bob KY3R and relayed via packet:

"(b) No amateur station may be operated under automatic control while transmitting third-party traffic, except an amateur station retransmitting digital communications on frequencies 50 MHz and above. Such stations must be using the American Radio Relay League, Inc. AX.25 Amateur Packet-Radio Link-Layer protocol, version 2.0, October, 1984 (or compatible). The retransmitted messages must originate at an amateur station which is under local or remote control."

This is, of course, mostly good, as it makes expressly legal the major operating practices of a large number of the 30,000 TNCs in North America. It sets a dangerous precedent in two ways, however.

First, it specifies AX.25, and a specific version at that. It would seem to freeze packet radio, at least for unattended packet BBS stations, at the 1984 level. If any new protocols are introduced, the developers must include in their time tables a magical mystery tour through the federal labyrinth for an STA or new rule-making action. This runs counter to the original wish to deregulate unattended operation enough so as not to impede packet development. I'm not blaming the FCC for this turn of events, mind you. I'm blaming the ARRL, specifically the Ad Hoc Digital Communications Committee, which is to say I'm blaming me.

If you're a regular reader here, you know that I'm a member of the ARRL digital committee, a group commissioned to advise the League on packet matters. When the specter of having AX.25 mentioned by name was first raised, I and most other committee members said that while we would rather not see AX.25 specifically mentioned in the waiver, it was better than nothing as long as the waiver was temporary and AX.25 did not end up in Part 97. As I recall, there was near universal agreement that mentioning a specific protocol in Part 97 would be a bad thing. Even though we should have seen it coming and should have done something about it, there is no one to blame but ourselves for having AX.25 in Part 97 as the ONLY protocol sanctioned for unattended operation. Rest assured that I'll bring the topic up at the next digital committee meeting. If you have thoughts on the subject, drop me a line.

The second bad thing is that this is, I'm pretty sure, the first time that the ARRL is mentioned by name in the body of Part 97. Even 97.112(b), which permits the W1AW operators to be paid, doesn't mention the ARRL by name. As I said in my first column for *73*, I think the ARRL is a mostly good thing. I'm a member and I work on one of its committees, but seeing it mentioned in Part 97 gives me an uneasy feeling. It's just as if the FCC said, "You must know the Morse code as defined on the Wayne Green code tapes." It gives me the creeps, as if someone walked on my grave.

In any case, the recent 85-105 ruling is a good thing for the near term. The bad part will affect only a small number of people in the next few months, but it could hurt all of us later as packet continues to evolve and perhaps to adopt new protocols. After all, the 85 in "85-105" means 1985. It took a long time to get this far.

High-Speed Modems

I received a message via packet regarding something I forgot to mention in the October column on higher speeds. Mark N2MH writes:

"...to get the really fast speeds 56K (64K if you believe in being compatible with ISDN) and 1.544 Mbps, full-duplex links for the duration of the connection will be required. This current ethernet-style packet will just fall apart at those speeds. You will probably find that even at current speeds, full-duplex links will dramatically increase throughput. All of your timing parameters for turnaround can be set really short once there is no turnaround.

"In the quest for faster radios, one should not overlook the use of rf modems. These are devices that are designed for use on broadband LANs (CATV technology). C-COR manufactures a device that goes from 30 MHz up to 216 MHz and can run 9600 on 25-kHz channel spacings."

Mark's comment on ethernet is a reference to our current simplex network, where the TNC turns your transmitter on, sends a packet, turns your transmitter off, listens on the same frequency for a packet, etc. If you run full duplex (transmitting and receiving at the same time on different frequencies), there is no turnaround time, and the black-hole effect does not exist. Thanks, Mark, for your message.

Although it's hard to be a rumor monger with a two-month publishing delay time, a rumor that will hopefully be fact by the time you read this is that a major TNC manufacturer (they have a three-letter name, but Vanna couldn't turn them over; you'd have to buy them) will soon be shipping a high-speed (9600 bps) rf modem. An rf modem is a box with a data port on one side and an antenna connector on the other. Connect a TNC (via its modem disconnect) to the data port and you're ready to go! High speed, fast turnaround. Drool. It will take an easy-to-install box like this to get some high-speed links up, I'm afraid. A good design for a separate modem, the one from K9NG, has been out for a while, but the amount of effort required to build it, modify a radio, get it running, and then talk someone else into doing it and get both of you together on the same frequency at the same time seems to be just the other side of that magic line that separates the "likely to occur" from the "fat chance." I'll try to get some hard facts on the new gear in the next month or two, and I'll let you know if it's as good as it sounds.

Packet DXCC

Table 1 is the most recent list of countries with known packet activity. Forward any new entries to NK6K @ NK6K. This list was compiled from information from W0RLI, WD4BIW, W9ZRX, N1DL, DU1POL, KB7G, K2AAA, AD8I, HK3BCA, W3IWI, WD9DHI, and WA6OWM, as of 11/5/86. Sixty-one countries are listed.

3D6	DU		HC	KH6	OZ	VK
5H3	EA		HH	KL7	PA	VP2M
5V	G	F	HI	KP4	PJ	W
9K2	GI		HK	LA	PY	XE
9M	GJ		HP	LU	SM	YB
9V	GM		HT	LX	ST	YJ
CE	GU		I	OE	TG	YV
CN8	GW		JA	OH	TI	ZF
CT1	HA		KG4	ON	T30	ZL
DL	HB		KH0	OX	VE	ZS

Table 1. Sixty-one countries with known packet activity.

Restricted BBSs—14.109 MHz

Some folks have been griping about the action taken by a group of HF packet BBS operators recently to restrict access to their stations. The 109 gang has a list of a small number of stations, and they'll only allow connects from the other people on that list. Anyone else is automatically rejected. Even worse, these guys hog an HF channel all day, every day. Time for tar and feathers, right? How about if I told you that these guys have moved more traffic for the general amateur community in the last two months than has been moved on HF packet since 1983?

A restricted BBS is one that allows only stations listed as BBSs to connect. Regular users are immediately disconnected if they try to connect. Restricted HF BBSs are a delicate subject, but in the great *73* tradition of a bull in a china shop, delicacy is no deterrent. To further explain restricted BBSs, let's discuss how the HF forwarding network works.

A forwarding BBS, as defined by the de facto standard introduced by W0RLI, has a list of stations that it forwards to. Each of the forward-to stations has a sublist of calls of people whose mail can be forwarded via that forward-to station. For example, my BBS has a list of stations I forward to, one of them is WB6KAJ-2. Two of the stations whose mail can be forwarded through WB6KAJ are W9ZRX and WB7DCH. Therefore, stored away in a file, is an entry that looks like this:

```
WB6KAJ-2
  W9ZRX
  WB7DCH
```

My BBS then knows that if I have a message for W9ZRX, it should send it to WB6KAJ-2.

My BBS has a parameter called the forward time, specified as a minute from 0 to 59. Once an hour, on the minute specified, if my BBS isn't already connected to someone, it scans the outgoing mail looking at each message to see if the destination call is on any of the forward-to lists, or if there is an @BBS option on the destination that is a forward-to station. If there is such a message, my BBS tries to connect to the forward-to station and pass the message along. It is actually more complex than that, but that's the general idea.

Several things will keep my BBS from successfully passing traffic:

1) If someone is connected to my BBS during the "forward minute."

2) If someone is connected to the forward-to BBS when my BBS tries to connect.

3) If the forward-to station is trying to forward to me or someone else at the same time that I try to connect.

4) If the channel is so busy that my TNC can't connect.

If the traffic is not passed during that attempt, the BBS waits until the next hour's forward minute. As you can see, the more people or BBSs there are on the channel, the less traffic gets passed. If a lot of traffic backs up, the chances increase that the other BBS will be busy when you try to connect or that someone will be passing traffic to you during your forward minute, which will cause more traffic to back up until you have hemispheric gridlock. In this state, a lot of rf is generated, but not many messages get passed.

The worst thing that can happen to a forwarding channel is for a human operator to connect to one of the BBSs. This type of connection tends to be less efficient due to the human think-time involved. That's the performance metric used to describe what you're doing between the time you ask for a list of active messages until you decide which one you want to read. Even worse is if the human asks for the long-style prompt, the help menu.

"The worst thing that can happen to a forwarding channel is for a human operator to connect to one of the BBSs."

Until recently, the status of the HF network, then on 14.107, was one of frequent gridlock. Several HF BBS operators, who determined that their major goal was to forward traffic between widely separated local VHF networks, and not to support direct services for a human on HF, decided to move to 14.109 and set up shop as mail-forwarding nodes, and not as BBSs. If a balance is made between the desire to cover all of North America and the need to keep the number of stations small, a restricted network can move far more traffic than an unrestricted network. Note that "restricted" here does not imply a limit on who can use the network, since anyone may place a message into the network on the VHF side. It only restricts those forwarding to a small group, and it restricts the network activity to forwarding.

Since the start of the 109 network, the forwarding of HF messages has improved dramatically. I'm not one of the 109 crew, but 30K bytes of traffic was moved from a VHF user in the Midwest to my VHF BBS in two hours through the 109 network. This would not have been possible in the gridlock of the previous network.

But TANSTAAFL (there ain't no such thing as a free lunch), so what do we lose?

1) Not everyone can be a forwarding station who wants to be. The same is true for two-meter repeaters—not everyone can have one who wants one. Strictly speaking, in some areas, there are more two-meter repeaters than are required if what you wanted to do was maximize communications. Two-meter analog utilization is a hard thing to measure, but on packet it's painfully obvious. And since there are a large number of people who want to get traffic from city A to city B, we do need to have some concern about efficiency. So, not everyone can be a forwarding station who wants to be, if we are at all concerned about network efficiency.

2) Not every area can have its own forwarding node directly on the main trunk. Some messages may have to be routed further on VHF than would be necessary if every VHF BBS had a local HF link, if efficiency is the goal. Least you think I'm harping too much on efficiency, at the current state of our network and the speeds we're running, there are usually just two levels of efficiency, "barely tolerable" and "the pits." It doesn't take much loss before you slide into the latter category.

3) For maximum efficiency, the frequency should be used only for the forwarding function. It is "lost" to the general community for other purposes.

4) Some users whose only access to the rest of the packet world is via HF are cut off. They can't connect to an HF forwarding node because it just disconnects them. What is needed, then, are a few HF stations, on a frequency other than 14.109, that can bridge to the forwarding network on HF. For example, if two W0RLI HF BBS stations are in the same city, one is the forwarding node on 14.109, another is an HF BBS on 14.107. Traffic is moved between those HF stations on VHF.

5) Any tightly controlled operation attracts problem operators. One type carries the control aspects to an extreme and becomes the Rambo of the airways. These guys have a telephone always ready, they have their eyes glued to the screen, and they never sleep. Any perceived infraction triggers an immediate outbound phone call. Another group can't stand order of any kind and tries to trash the network. Both types are a royal pain in the bit bucket. There is a third type of operator who feels that if a machine is on the air, it's his FCC-given right to use it. The best response I've heard to that one is, "I give him the same access remotely that I'd give him if he were in my shack."

The question the packet community has to answer is whether or not the disadvantages expressed in 1 and 2 are a reasonable price to pay for the increase in network performance. Lest some think that I'm talking about turning the amateur packet radio network into a common carrier, I'm not. An efficient network, or the experimentation to see how efficient we can make it, certainly falls within the boundaries of this oft-quoted passage:

> "[Amateur radio is] a radiocommunication service for the purpose of self-training, intercommunication, and technical investigations carried out by amateurs, that is, by duly authorized persons interested in radio technique solely with a personal aim and without pecuniary interest."—Article 1, section III, paragraph 3.34, *Radio Regulations*, Geneva, 1979.

Next, can the general amateur population support number 3? They've gone along, more or less, with the SSTV calling channel and the 14.000-MHz beacon network.

Finally, can the forwarding node operators support the facility mentioned in number 4? Can they live with the operators in number 5 and still have fun?

If we can make it work on HF, maybe we can try a cellular approach to VHF network devices, where users intentionally limit their output power and pattern so as to avoid interference with other network devices. More about that another month.

I mentioned some packet newsletters a few months ago and thanked them for sending me copies. I'd like to mention two more, *SANDPAC* from the San Diego club and *RMPRA> PACKET*, the Rocky Mountain gang. Next month, check in to see if I made my plane to Boston.■

ABOVE AND BEYOND

Number 13 on your Feedback card

Peter H. Putman KT2B
84 Burnham Road
Morris Plains NJ 07950

PREAMPLIFIERS

As you are reading this, no doubt Santa Claus has come and gone and hopefully left you with some nice VHF/UHF goodies! Maybe it was a new beam . . . a new amplifier . . . a multimode, perhaps . . . or a transverter . . . ? One thing is for certain: There's no shortage of equipment today for the VHF/UHF enthusiast. To my count, right now there are more than 20 companies that come to mind that make a broad range of equipment—from exciters, amplifiers, and receivers to antennas, converters, and transverters. And this doesn't include the basement operations that show up at flea markets selling home-brew preamps, antennas, and the like.

What's the most popular piece of VHF equipment? My guess is that it would be a preamplifier. I have yet to meet a ham of any type who feels his or her radio "hears" well enough, especially at 6 meters and above. Which brings me to this month's topic: preamplifiers and how to determine if they are working as they should.

The number most of us are concerned with when discussing preamplifiers is gain, expressed in decibels (dB). Many preamplifiers are sold strictly on gain figures with no consideration for any other parameter—yet those other parameters are just as important (if not more important). Such things as MDS, IMD, and 1-dB COMP need to be considered as well. "Hey, what were those abbreviations?" I hear you asking. Let's go through them one at a time.

MDS stands for minimum discernible signal. This is the absolute lowest level signal that can be detected by the preamplifier and is usually measured with a signal generator driving the preamplifier into a spectrum analyzer, usually in a very narrow bandwidth (say 1 kHz). The limitations here are the atmospheric noise (more of a limitation at 220 MHz and down), the device noise (more of a limitation at 432 and up), and the gain of the device used in the preamplifier. Typical MDS readings might be as low as −120 dBm for a well-designed MOSFET preamplifier and −130 dBm for a GaAsFET device.

Another parameter that goes hand in hand with MDS is dynamic range, the range over which the preamplifier is linear. How is this determined? First, we need to determine the 1-dB compression point (1-dB COMP) as mentioned earlier. This is the point at which the preamplifier's gain figure drops by 1 dB for a given signal input level. Usually, this level will be very strong—on the order of −20 dBm or better. When a given input signal can no longer be amplified by the specified gain figure, we say the preamplifier is compressing at that point—hence, the term 1-dB compression point.

For a well-designed preamplifier, the 1-dB compression point should be in excess of 0 dBm. Some preamplifiers I've measured have been as high as +7 dBm (outstanding!) and as low as −6 dBm (mediocre). What does it mean to you as a preamplifier user? Well, consider that most preamplifiers available today have enormous gain bandwidths. At 432 MHz, a gain bandwidth of better than 10 dB over more than 20 MHz is not unusual. A preamplifier rated at 20 dB at 432 MHz could easily have 18 or better dB of gain at 440 MHz.

If you live next to or near a strong repeater at that frequency, your preamp will amplify that undesired signal to the tune of 18 dB. But if that signal is already better than −20 dBm to begin with (a very strong signal, indeed) and your 1-dB COMP point is only −4.5 dB, your preamplifier will start to compress and become nonlinear. And we all know what that means—intermodulation distortion (IMD) products are created on the signal you wish to hear, creating all kinds of signals and garbage on that weak signal. Horrors!

If you live in a high rf density area (such as a major metropolitan area) or near a hilltop with multiple radio services (such as repeaters, TV or FM stations, and public-service links), you could be asking for trouble by using that super-duper gain preamp to the point that you'd be better off without it. No question about it, you need a preamplifier with a wide dynamic range figure!

Let's get back to that preamp with 20 dB of gain at 430.00 MHz. The MDS is −125 dBm, not bad. The 1-dB compression point is only −2 dBm, not so good. That means the dynamic range is only 103 dBm, which, although adequate, can be improved.

Now, let's look at a typical GaAsFET preamplifier running only 12 dB of gain. The MDS tests out to −130 dBm in a 1-kHz bandwidth. The 1-dB compression point is +5 dBm, which is very good. Now the dynamic range is 123 dBm, a full 20 dB better than the first preamplifier and probably a better choice in your installation, since strong adjacent signals aren't going to blow your front end away while you're trying to work that new grid square just one-half S-unit out of the noise.

Past experience has led me to several conclusions: First of all, gain isn't everything. Preamps I've tested with only 10 to 12 dB of gain often far outperform preamps with 18 to 20 dB of gain when it comes down to those magic letters . . . IMD, MDS, and 1-dB COMP. Next, it makes no sense in any event to run 20 dB of gain into your multimode's MOSFET or GaAsFET front end if it will exceed the 1-dB compression point of that same front end. Then you're really asking for it!

> ***"How much are you giving up if you forsake that 20-dB preamp for 10–12 dB of 'clean' gain?"***

The best designs for widest dynamic range and gain employ a balanced mixer with a well-designed low-noise preamp running about 12–15 dB gain ahead of it. This results in the best receiver performance possible, and indeed designs like this are now showing up in amateur equipment for 50 and 144 MHz. One that comes to mind is the new Microwave Modules MMT-144/28R transverter, which employs an NEC GaAsFET running about 12 dB gain to a balanced diode ring mixer. Let me tell you, it is an outstanding contest performer.

So how much are you giving up if you forsake that "wild," unrestrained 20+ dB preamp for 10–12 dB of "clean" gain? On a signal that is S1, a 12-dB preamp will raise it two S-units to S3. Fifteen dB will raise it to S3-1/2, while 18 dB will raise it to S4, but might also create some other interesting junk, such as a television program from an adjacent television transmitter reading S7, driving you crazy trying to figure out what it is on SSB or CW. Of course, if things get slow, you could actually switch to FM mode (if you have it) and try to listen to that 200-kHz-wide signal for kicks.

At my station, I use the MMT-144/28R with the companion MML-200-S power amplifier, which also has a 12-dB preamp with excellent dynamic range. At times I switch in the preamp, putting 12 dB ahead of 12 dB for a total of 24 dB of gain. Now, when there's no strong local activity, I can get away with this. Should a local come on with some power, "good-bye, DX contact" as I'll hear nothing but hash. Therefore, the preamp stays out of the line most times as the GaAsFET front end in the transverter is more than adequate.

Just remember those magic letters—MDS, IMD, 1-dB COMP—and you won't go wrong with a preamp. Reputable manufacturers will readily make this data available to you upon request.

KLM Price Increases

What's up, KLM? Has anyone looked at the prices for KLM antennas recently? Holy cow! An average of 80% increase in many cases for such items as the JV-2 J-Pole 4-element, 2-meter beam and more than 50% on such items as the 144-16 LBX and 22C antennas! I'm not sure what's going on at KLM, but I can tell you that many amateurs are very upset at these price increases. It seems that the VHF/UHF line took the hardest shots. The aforementioned J-Pole went up nearly 70 dollars in price . . . unbelievable.

This certainly puts KLM at a competitive disadvantage with such manufacturers as Cushcraft, Tonna, Hy-Gain, and others! Couple this with KLM's previous problems of miscut coaxial baluns for their long-boom 144 and 220 antennas (resulting in feedpoint impedances of 2:1 or higher) and what you have is a line of antennas that may become extinct. Already, many dealers are grousing about dropping the product line due to excessive pricing. That would be too bad, for KLM has long made some of the best antennas around, including those work

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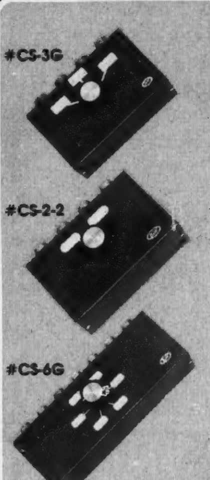

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horse 4-element beams (one of my favorite antennas—I use five of them in various applications, including my beat-to-heck mountaintop version!).

Well, there are other sources for antennas. Cushcraft still sells a 4-element beam for about half the price that works just as well. And I've come across an interesting new product made by Tonna Antennas: a 9-element, portable 2-meter beam using nothing but wing nuts for assembly! This will become my portable 144-MHz antenna from now on, with the 4-element KLM relegated to test-range duty. I'll try to have a report on this antenna for you in the next month or so.

PackRats Review

I've mentioned the Mt. Airy VHF Radio Club in the past. I've also mentioned their excellent PackRats Flea Market held every October, and this year's edition was one of the best I can remember. Several major dealers were there, and there was a wealth of surplus VHF/UHF/SHF equipment to be had, as well as other flea market bargains. Among the more interesting items was a cute little 13-cm transverter made by LME Electronics of England and sold by DownEast Microwave. This unit is also available in 23- and 33-cm versions, with two different power levels, and as a kit or wired. (Phew! Think that's enough options?)

Bill W3HQT is the proprietor of DownEast and also sells a fine line of loop yagis for 33, 23, and 13 cm, as well as power-amplifier modules for those bands. I suggest you contact Bill for a catalog at DownEast Microwave, Box 1655A, RFD #1, Burnham ME 04922; (207)-948-3741. He has a nice catalog and price list. I'll try to pry one of these transverters loose for a review in a future issue.

Another interesting display was made by Jacob Schmidt and Son, Inc., who deal in stainless steel and have a wide variety of hardware including U-bolts and clamps for antenna work. Their catalog can be had by writing to: 1908 Sumneytown Pike, Harleysville PA 19438.

VHF Shop Update

I can now state that The VHF Shop has officially gone out of business and is in the process of liquidating inventory at local hamfests. Tom Waldron KQ3R showed up at the PackRats with a table full of nondescript Mutek, SSB, and Tonna items at greatly reduced prices, sending many hams home with a bargain.

Tom also told me that he is not taking any more mail or phone orders, so if you still wish to purchase some of the products Tom was distributing, be aware that Hans Peters VE3CRU of Transverters Unlimited in Canada (PO Box 6286, Station A, Toronto 1P3 M5W, Canada) carries the Mutek and SSB line (416-759-5562), as does Gene Shea KB7Q of "Q" Products, 417 Staudaher Street, Bozeman MT 59715; (406)-587-9150.

Letter of the Month

Harry Johnson NV7K writes in to ask how he can use his VTVM to read out power and swr. Simple! Use the VHF/UHF wattmeter board from the "Elementary, My Dear: Watts 'n' Swr" article (September, 1984). I've got about 15 left for the grand total of $10 per board. Although they were designed to work into a 50-uA meter, there's no reason why you couldn't use them with your VTVM—or VOM for that matter. If you have a Simpson 260 with a 50-uA scale, you're in business already.

Failing that, a time-tested circuit has been available for years using the Monimatch (mentioned in the October Above and Beyond) in the ARRL *Handbook*, and it too can be connected to a VTVM or VOM for readout. I hope this helps out!

Finally, it is January again, and that means the ARRL Sweepstakes. This is an excellent time to check out your station's performance (especially due to the abundance of weak signals on the air) and have some fun as well. The contest runs from Saturday afternoon to Sunday evening, and you'll see activity on 50, 144, 220, 432, 902, and 1296 MHz, as well as the occasional microwave contacts on 13 cm and above.

I have just finished remodeling my basement ham shack, putting in styrofoam insulation and sheetrock where there used to be masonry exterior walls. Boy, it's a lot warmer in there now!

If you are near the East Coast, look for KT2B on 6 through 1296 during the weekend. I might still decide to go mountaintopping with snowshoes and cross-country skis on 144 and 432 MHz from FN22 with the new 9-element F9FT antenna and who knows what radios. Until then, see you Above and Beyond! ■

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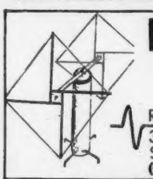

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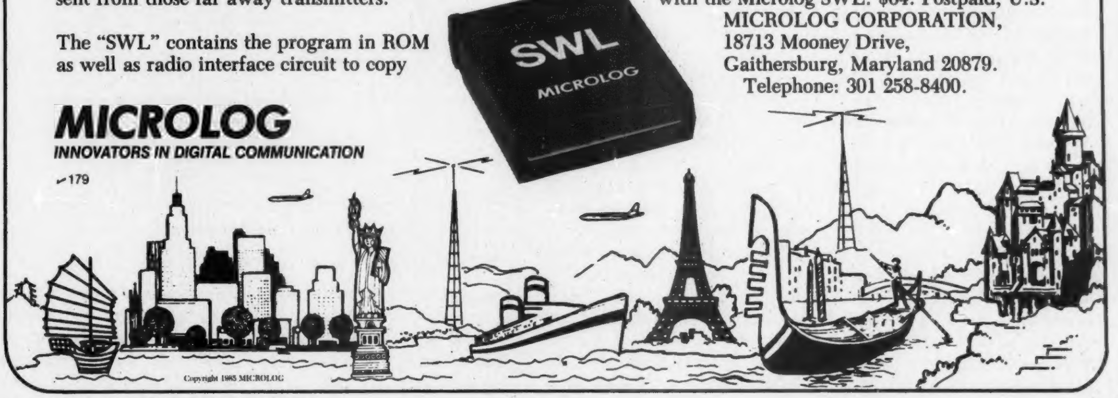

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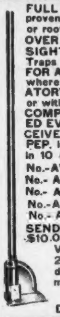

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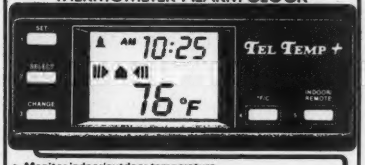

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HAMFEST GOODIES

The last several columns should have put your junk box in very good condition. I hope some of my hints for mail ordering have paid off. There is but one more place to look for parts to finish stuffing the junk box: hamfests. It is true that in the past few years, the number of hamfests have been dropping, perhaps due to the drop in new hams coming into our hobby. But, they are still gold mines for part shopping—even if not for new parts, then just for plain junk.

As an example, a broken 23-channel CB radio is junk to most people. To the low-power operator, it is a treasure chest full of goodies. With a little bartering, you can purchase one for less than five dollars. From the unit, you can expect at least one speaker, a microphone, a 4-Watt final transistor, various low-level driver transistors, and handfuls of smaller components. That's not a bad haul for a few dollars.

I gut, sort, and test all of the above parts. I don't worry about the smaller resistors or ceramic capacitors. It's just not worth the effort to remove them. I can purchase all of the resistors new for less money and time than it takes to remove them from a printed circuit board.

I for one like to build my equipment from solid-state devices. Those old CB radios are a good source of parts. But have you ever given thought to building something with tubes? Please don't get me wrong. I like the technologies of the 80s. I also like a good bargain when I see one. I'm talking about the old mobile radios. There are several different models, most made by Motorola, General Electric, or RCA. I have seen them go at hamfests for as little as a buck each.

So, what good are they? Well, they are just full of parts—tube-type parts. Most have a 6146 tube as a final, a 2E26 driver, and perhaps even a 12BY7. The power-supply components alone are worth more than the price of the radio. One has only to try running a home-brew transmitter using a tube or two to really feel the ham spirit. I have been operating a 6L6 one-tube job for a year or so. If there is enough interest, I'll print up the plans here in this column.

I have noticed several things when I see someone else's home-brew gear—a lack of good-looking cabinets. I always try to pick up a good-looking box or chassis when I shop the hamfests. It is hard to buy a chassis or cabinet by mail. The pictures are never very good; neither are the descriptions. The extra shipping cost will eat you alive. I like to be able to handle and eyeball the cabinet. Don't forget Radio Shack for a source of good-looking boxes to house your QRP project in. The new styles they carry are not too bad.

To finish stocking up on the junk box, how about a good hunk or two of copperclad board? Get some double-sided stock as well. It's great for shielding and for making up small cabinets. Soldered together, it makes for a strong chassis.

Building an Swr/Wattmeter

Now that we are finally done with the parts, let's put something together. A low swr is very important to the QRP operator, as high efficiency is one of our many goals. Running low power is the acid test for your antenna system. With a handful of parts, you can construct a sensitive swr/wattmeter very easily. The small wattmeter shown in Fig. 1 is a classic in design. I take no credit for it. Several different styles have appeared in several different magazines.

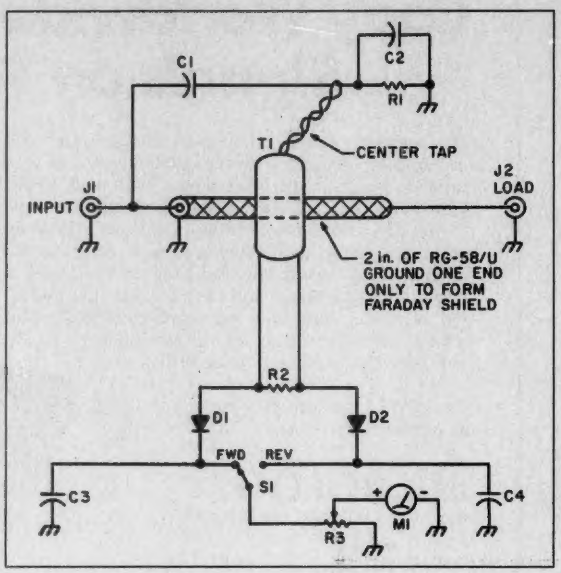

Fig. 1. Swr/wattmeter.

As little as 1 Watt will deflect the meter full-scale, with a frequency coverage from 1.8 MHz to 30 MHz. There's not much to it. The signal traveling in from the transmitter to the antenna establishes an electric field between the inner and outer conductors and a magnetic field around the conductors. The line from the coax forms the primary of the transformer, T1, and so the alternating magnetic field induces a voltage in the center-tapped secondary winding. That winding is loaded by R2, a 56-Ohm resistor. C1 samples the electric field and is adjusted so that when the load on the output side is 50 Ohms resistive, the voltage injected into the tap of T1 aids the voltage in one half and exactly cancels the voltage in the other half. Any load that departs from 50 Ohms resistive will cause less cancellation and will be indicated by the meter.

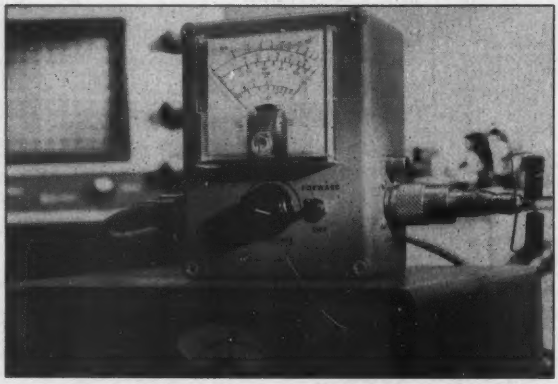

Photo A. The QRP swr/wattmeter shown with the HW-8, built using junk-box parts.

I used a Bud seamless aluminum box to hold the wattmeter. It's die-cast aluminum—very easy to work with and rf-tight. At this power level (less than 20 Watts), a plastic utility box could be used. However, I like to place rf test gear in a metal cabinet if possible. Radio Shack provided me with copper perfboard to mount the parts on. The junk box supplied a very nice 50-uA meter. All components are self-supporting and are mounted directly to the perfboard. Do be sure to use 1N34 diodes in the bridge. The more popular 1N914 diodes have too high a junction voltage to be used at this power level.

Check over the wiring for errors. With a 50-Ohm resistive load connected to the output, apply a small amount of rf. Adjust R3 for a full-scale meter reading in the forward position. Apply more rf if needed. Switch S1 to read reflected power. Now adjust C1 for minimum reverse power indication. Repeat the above adjustments on the highest band to be used. The swr/wattmeter can now be calibrated as needed. My meter came with a nice faceplate, so I left it as is. Apply some paint and rub-on lettering and you're done. The swr/wattmeter will find a good home next to your latest QRP transmitter.

Let me switch gears for a moment. If you'd like to see small projects like this in the QRP column, drop me a note. There are quite a few smaller projects that can be discussed here. Remember, it's your column.

SOFTWARE EXCHANGE

Since we're switching gears, let's drop down to four-wheel low. The operator of low power has to get the most out of his/her equipment and antennas. Optimum efficiency sometimes requires tweaking and pruning in the smallest degree. Close only counts in horseshoes and hand grenades—not in QRP.

In an effort to get the most out of the QRP operator's equipment, about six months ago I started collecting public-domain ham radio programs for a software exchange. Antenna design, MUF plots, and power-supply designs are just a few types of programs that are available. Right now I can support the following formats and machines: IBM/MS-DOS; Apple II, //e, and //c; the Radio Shack Color Computer (with both disk and tape support); and the Commodore 64 (disk only).

Currently, I have public-domain programs for all the above except the C-64. Where is the large software base for this machine? Several people have already taken advantage of the exchange. To get the programs, tell me what machine you want the programs for. If you want just a listing of programs for that machine, an SASE will bring it. To get the programs, either send a formatted disk with return postage and a note listing the program(s) wanted or send me $2 per disk, and I will send you a GOOD disk with the desired programs copied on it. I make no money from this. The cost covers the disk, disk mailer, postage, etc.

Please also send me your public-domain programs to add to the growing exchange. I'll copy your disk and return it with some different programs. Into programming? Send me your creation for the exchange. The more software I receive, the more we can exchange. Right now, there is a good supply of programs for the CoCo and Apple series. I just started to get some for the MS-DOS-based machines—two very fine CW/RTTY programs.

That's about all for this month. With the snow on the ground and the cold winter nights, look for me on 40 CW—QRP, of course! ■

Swr/Wattmeter Parts List

C1	5–25-pF trimmer capacitor
C2	270 pF ± 5%
C3, C4	.047 pF
R1	1k, 1/2 W
R2	56 Ohms
D1, D2	1N34 germanium diodes
T1	15 turns #20 on FT-50-43 core
M1	0–50-uA meter
S1	SPDT switch
J1, J2	Coax connectors

HAMSATS

Number 17 on your Feedback card

Andy MacAllister WA5ZIB
2310 Romayor Court
Pearland TX 77581

WELCOME, ANDY

All right! A satellite column! You'll find out about Videocypher II crackers and pirates, HBO and Cinemax de-scramblers with only two chips, perfect C-band reception with a 12-inch dish, and complete systems with 30-degree LNAs for only $29.95 postpaid. Right? Well, not quite. But now that I have your attention, I am going to explore some topics with this column that are potentially more exciting than all of the above.

I enjoy my TVRO (television receive only direct via satellite), but if all I wanted to do was monitor, I wouldn't be a ham. My amateur radio license is my ticket to talk. Why just listen or look when I can do my own broadcasting? How about packet QSOs through a "mailbox in the sky" or RTTY contacts via a Russian satellite? Watching "raw feeds" of football games can be entertaining, but it's nothing like the thrill of chasing an elusive country on a low, horizon-skimming OSCAR pass.

After several thousand QSOs through every transponder-type satellite since AMSAT-OSCAR 7, my enthusiasm for the amateur radio satellite program is stronger than ever. The OSCAR (orbiting satellite carrying amateur radio) program neatly combines my interest in the space program, computers, and amateur radio.

By the way, Wayne Green introduced me to this hobby back in 1966. My father picked up a copy of *73* at the local English bookstore in Tehran, Iran, and I was on the air as WN5ZIB within months of my arrival back in the States. I am as active as possible on the satellites and with AMSAT (the Radio Amateur Satellite Corporation), but two preschoolers and the XYL (WB5RMA) put certain constraints on total immersion into satellite chasing.

With this column, I will have plenty of room to cover how-to topics, newcomer hints, new satellite proposals, awards, contests, and news, though situations in the world of the "hamsats" can change very rapidly.

Enough introductions. Where do these "birds" come from? How did the amateur radio satellite program get started, and what can you do NOW to learn more about the satellites and do some chasing of your own?

The Growth of Satellites

It was 25 years ago, December 12, 1961, at 2042 UTC, when an Agena-Thor rocket lifted majestically skyward from Vandenberg Air Force Base in California with a very special ten-pound box in place of ballast. The box was called OSCAR 1. This small satellite, built by hams, sent "HI" in CW on 145 MHz with 140 milliwatts to a simple whip antenna. During its 22-day life, hundreds of hams in dozens of countries heard this signal from space. Amateur radio, a hobby, had joined the space age only four years after *Sputnik 1* became man's first artificial satellite to orbit the Earth.

Since that memorable day a quarter century ago, the concept of amateur radio satellites has flourished. The OSCAR Association of Sunnyvale, California, the group responsible for OSCAR 1, later became Project OSCAR, Inc. They exist today supporting AMSAT, whose main purpose is to provide satellites for amateur radio communication and experimentation.

Efforts to create new satellites continue with affiliated groups worldwide providing space-ready hardware. Some of the countries directly involved include the United States, West Germany, Japan, the United Kingdom, the Soviet

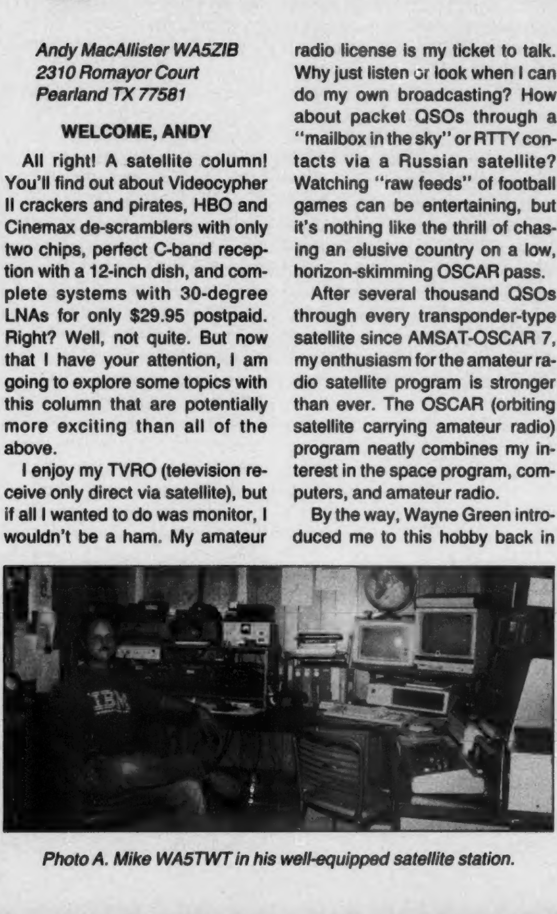
Photo A. Mike WA5TWT in his well-equipped satellite station.

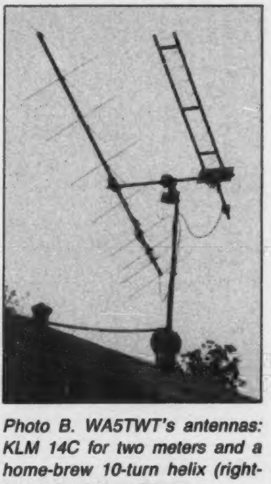
Photo B. WA5TWT's antennas: KLM 14C for two meters and a home-brew 10-turn helix (right-hand circular) on 70 cm.

Union, Australia, France, and Hungary. Other groups providing support include New Zealand, Canada, South Africa, Brazil, and Mexico. Our most recent hamsat, Fuji-OSCAR 12, was designed and built by Japanese hams and then launched from Japan on August 12, 1986 into a 1,500-kilometer circular orbit.

Satellite Spectrum

Amateur radio satellite activity is not a specialized mode of communication like packet, RTTY, facsimile, or slow-scan television. The hamsats represent NEW HAM BANDS. Each time a satellite goes up, we have new space to make contacts with other hams. You might say that the space already existed as ham frequencies, but for the most part, the satellite-allocated subbands are in unused areas of VHF and UHF amateur allocations.

Mode L on AMSAT-OSCAR 10 used a 1269-MHz uplink with a 436-MHz downlink to provide 800 kHz of operating room. That's more spectrum than the 40-, 30-, and 20-meter bands combined. With the exception of fast-scan TV, you will find many of the "specialized modes" of amateur radio in use on the ham satellite transponders.

Uo-9 and Uo-11

You probably have ham rigs on hand that can get you started with amateur radio satellites right now. ANY two-meter rig in reasonable condition can hear UoSAT-OSCAR 9 and UoSAT-OSCAR 11. These experimental scientific and educational spacecraft were built at the University of Surrey in England and launched as secondary payloads on American boosters into low polar orbits. Uo-9's altitude is almost 500 kilometers, while Uo-11's is almost 700.

They transmit telemetry on either the two-meter band or the 70-centimeter band. Except for special experiments, the two-meter frequency is preferred. Set your handie-talkie, mobile rig, or home station on 145.825 MHz FM. Eventually, one of the two UoSATs will come over.

The signal format can be anything from synthesized voice to CW, RTTY, or ASCII. Typically, expect to hear 1200-baud ASCII. If you have a 1200-baud modem handy, hook it between the rig and your home computer for some interesting bulletins or telemetry. Uo-9 and Uo-11 can each be heard about six times every day, for about 15 minutes per pass. Dr. Robert Diersing N5AHD wrote a very detailed paper on automatic station control, data acquisition, and telemetry processing, but for a quick introduction to the hamsats, just hearing signals from space with an HT is amazing.

Fuji-OSCAR 12

But what about the communication-type satellites? The newest and most reliable one is Fuji-OSCAR 12. This satellite uses a two-meter uplink and a 70-centimeter downlink and has two transponders called JA and JD. The "J" refers to the frequency configuration of 145 MHz up and 435 MHz down, while the "A" stands for analog and the "D" for digital. When the JA transponder is on, the JD system cannot be used. The reverse is also true. The analog transponder is continuous and is intended for SSB, CW, RTTY, SSTV, FAX, or similar signals, while the digital transponder is for AX.25 packet communications.

The analog transponder is 100 kHz wide and is inverting. When you transmit an LSB signal below the center of the passband, the downlink will be USB and above center. Fig. 1 shows the analog transponder band plan. The use of circularly polarized beam antennas, low-loss feedline, and a preamplifier will be rewarded with quality contacts on FO-12.

Several multimode rigs are available today for use with mode J. Some of those used most often include the Yaesu FT-726R, the Kenwood TS-711 and 811, and the ICOM IC-271 and 471 series. In my case, two Yaesu HF rigs with appropriate receive and transmit conversion make almost any "mode" possible. Those hams with inconvenient setups—ones that require wiring changes or system modifications before every operation—make few contacts and soon lose interest.

The digital transponder, mode JD, uses discrete channels rather than a continuous band of frequencies. When this mode is in operation, the analog transponder will be off, and FO-12 becomes a store-and-forward mailbox like an orbiting packet digipeater with a computer. This "digi" has coverage of much of the Earth's surface in the course of a day. A message could be left for a friend in California as easily as for one in Australia. The uplink channels listed in Fig. 2 require FM, while the downlink is SSB.

The standard packet station will need a few extra items to allow compatibility with the satellite. These include antennas suitable for satellite work, a 435-MHz SSB receiver, and an interface box to go between the TNC and the radios.

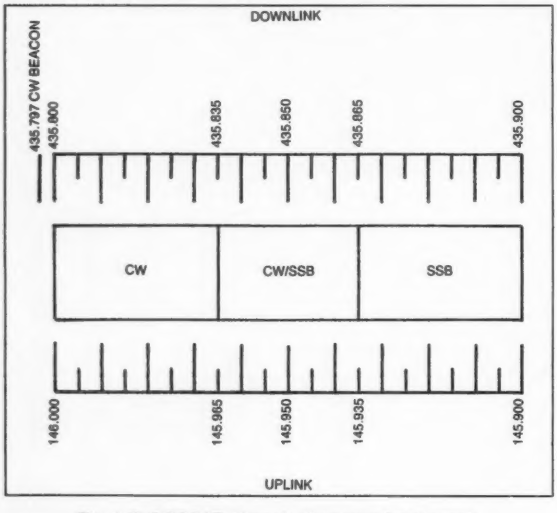

Fig. 1. Fuji-OSCAR 12 analog transponder channels.

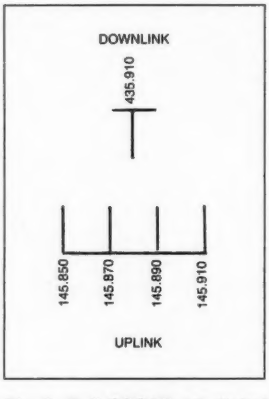

Fig 2. Fuji-OSCAR 12 digital transponder channels.

Mode JD is new and is not for the beginner. Experience with the analog mode on FO-12 and knowledge of terrestrial packet activity on two-meter FM or HF are helpful.

Other Birds

We have other amateur radio satellites in orbit. Any attempt to second-guess their status at the time this material goes to print would be impossible, but a description of their present situation is in order.

AMSAT-OSCAR 10 was launched in 1983 on an Ariane rocket to a high elliptical orbit. For several months now it has suffered many setbacks due to progressive memory failure induced by radiation damage. Many attempts have been made to reverse this problem, but with few results. Rescue efforts will likely continue as long as there is any chance to squeeze more useful life from this extraordinary international hamsat.

It carries two transponders, one for 435–145-MHz operation and another for 1269–436-MHz operation. The nature of its orbit has allowed DX contacts almost to the opposite side of the Earth.

The Soviet Union has been responsible for no less than ten amateur satellites in recent years. They include the "Radio" and "Iskra" series. Radio 7, the best satellite from the last group to be launched (1981), may still be available for communications, but its failing batteries have resulted in reduced operating schedules whenever eclipsing of the sun takes place. The Iskra satellites usually last only a month or two and have yet to do more than provide beacons on ten meters.

The transponder on Radio 7 uses a two-meter uplink and a ten-meter downlink with a beacon frequency of 29.501 MHz. In the months to come, we expect at least three new Soviet amateur satellites, including Radio 9, Radio 10, and Iskra 4.

Suggested Reading

Just a few years ago, it was difficult to find sufficient data on ham radio satellites without gathering quite a pile of old magazines, obscure journals, and books. To get a really good single source of in-

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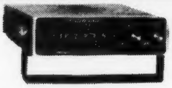

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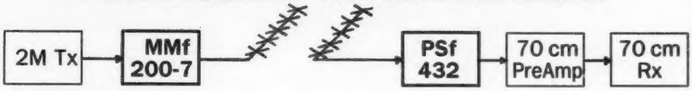

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formation, I would suggest a copy of *The Satellite Experimenter's Handbook* by Martin Davidoff K2UBC. It is available through AMSAT for $10 postpaid to The Radio Amateur Satellite Corporation, PO Box 27, Washington DC 20044.

For more information on Fuji-OSCAR 12, Project OSCAR has the *JAS-1 Satellite Handbook*. It was originally printed in Japanese but has recently been translated into English. The price postpaid is $10 to *JAS-1 Satellite Handbook*, Project OSCAR, Inc., PO Box 1136, Los Altos CA 94023-1136.

To keep up with changes in satellite status, the *Amateur Satellite Report* from AMSAT is sent to members at least once a month. This newsletter provides orbital tracking data and information on upcoming missions and present projects. The membership fee of $24 per year (from the Washington DC address above) helps pay for new satellites.

If you have OSCAR-related questions, send them to me. Although I cannot respond to each individually, I will be covering many topics in the months to come and would really appreciate the input.■

RTTY LOOP

Number 26 on your Feedback card

Marc I. Leavey, M.D. WA3AJR
6 Jenny Lane
Pikesville MD 21208

The most obvious way to begin this column, of course, is by wishing each and every one of you a HAPPY NEW YEAR! It may be overdone, but as each year ticks by, I look into my children's eyes and wonder what the next century, just a baker's dozen years away, will bring, not only to electronics and ham radio, but to our entire way of life. It does make one pause and think.

One of you who did take a few moments to think was Frank Fox WA6KGD of Hayward, California. Frank provided the first answer to the "Green Keys" question, remarking that he has "sat many a night and punched the 'Green Keys' (cushioned at that) on a Model 15 Teletype®. For that matter, I punched the same keys on a Model 21 Teletype." That's right, those of you who never laid eyes, much less hands, on an original mechanical monster, the keyboards of the classic Teletype Corporation machines were made up of green keys, thus the moniker "Green Keys" for this hobby of ours.

Frank also addresses one of the expressed needs of several of our RTTYphiles—running RTTY on an Apple //c computer. He tells me that he purchased the rights to market Super-RATT, originally written and marketed by Richard Landsman, and has maintained his interest in keeping "one of the best communication programs alive and well. The program works on all Apples including the //c.

"The program can be used with virtually any terminal unit; in fact, there are several options in the configuration program, including the Alex Masimo internal Terminal Board for the Apple, the HRA terminal unit, and terminal units that had been wired up to use the game I/O for the Galfo program.

"The program is primarily a machine-language program, which lets it operate in a speedy manner and is interfaced rather neatly with a Basic program that lets the user make changes in the program to suit his needs. The Apple when powered up automatically boots and runs any predesignated program in drive one . . ." so that using the program is simple and convenient.

The manual is supplied on disk and is more than 50 pages in length. It comes in standard Apple file format, so that it can be printed out with a word processor program or the short Basic program provided on the disk.

Now I hear some of you clamoring in the back for a few details on this program. A quick rundown includes RTTY speeds of 40 to 300 baud and Morse from 5 to 100 wpm, with Baudot, Morse, and ASCII capabilities. Both a bulletin board system and selective call are included in the program. A receive buffer, initially set at 10K, is included, and information can be saved to or retrieved from disk. A split-screen display holds all kinds of information, and there is even a simplified QSO log on screen.

More? I don't know . . . how about a word or character mode of transmit, automatic carriage return, real-time hard copy with printers that sport a buffer, automatic or selectable ID, temporary string storage, file transfer mode, bit inversion, even on-line help? How much longer do I have to go on? This does, from the specs at least, look like its name "Super-RATT."

Go ahead and drop Frank a line at 186 Isabella Street, Hayward CA 94544, and tell him you read about it in *73*'s RTTY Loop. I'm sure he will be happy to send you the full details. And any users of Super-RATT, let me hear from you as well.

One user I have heard from is Frank C. Krushina K4DW of Merritt Island, Florida, who is using Super-RATT with his Apple //e. He didn't complain, so I guess he likes it. Huh, Frank?

Robert L. Dingle KA4LAU of Dayton, Ohio, writes that he is trying to get the TRS-80 Model 100 RTTY program shown in the July, 1986, RTTY Loop working on his NCR Decision Mate V computer. He says that all he got was an error message that said, "SUBSCRIPT OUT OF RANGE LINE 120." Assuming that this is a similar machine to the Model 100, my only guess is that the line may have been entered wrong. The listing as shown in the column used a form of "pretty printing" that lined up the contents of the line with the text following the line number. The line should read:

```
120 F$=" 3"+CHR$(10)+"_
  "+CHR$(7)+"87"+CHR$(13)
  +"$4',!:(5"+CHR$(34)
  +")2#6019?8 ./;"
```

Watch out for the spaces. There

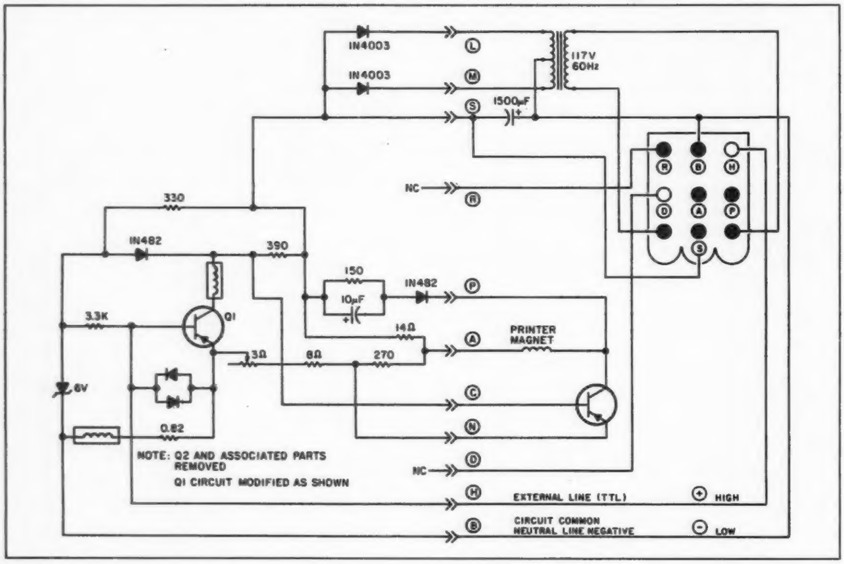

Fig. 1. Model 33 ASR TTY printer magnet driver board (as modified for TTY level signals). Note: Q2 and its associated parts have been removed; the Q1 circuit has been modified as shown.

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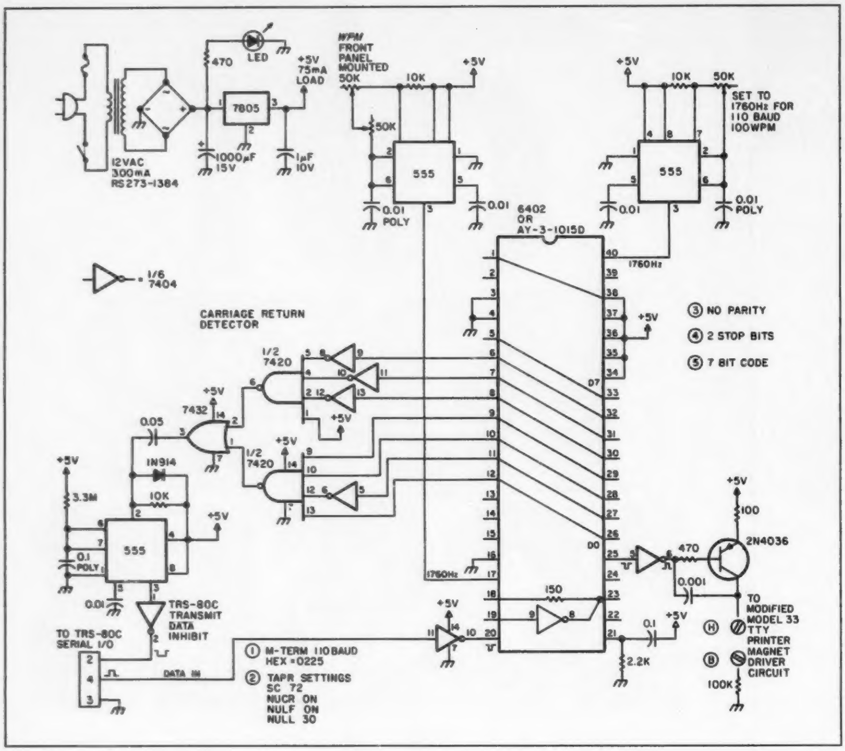

Fig. 2. Interface unit diagram. Hard copy with a Model 33 ASR.

should be one in the first quoted string (space 3) and in the second, after the CHR$(10) (underline space). There is one more, in the last string, between the 8 and the period. If you count the characters in the string, with each CHR$() as one character, you should get 31 characters. The Baudot LTRS character set is in L$, and the FIGS character set in F$. They should both be the same length and represent the same characters in the same order, just with a different case. Let me know if this solves the problem.

Some time ago, Louis I. Hutton K7YZZ of Bellevue, Washington, acquired a Model 33 ASR Teletype machine to replace a Model 28 KSR that was connected to his Digital Group Z-80 computer. The problem with the Model 28 was that when the print driver routine was changed from Baudot to ASCII, an ASCII-capable machine, such as the Model 33, was needed. Once a modification to the Model 33 to allow driving with TTL-level signals from the Digital Group computer was accomplished, all was working just fine.

Then Louis got interested in packet and assembled a new computer system to replace the Digital Group. The computer picked was a TRS-80 Color Computer, but when he tried to connect the Model 33 to the RS-232 output of the CoCo, he had a few problems.

Louis notes that the printer would print right across the page and pile up at the end of the line. It apparently did not recognize the carriage-return and line-feed signals from the computer. During a literature search for data on the Model 33 and its applications, he found several hints on possible solutions to this problem. First, the computer was programmed to limit its line length to 72 characters. Then a circuit was designed to tell the computer to stop sending and wait until the Model 33 had finished its carriage return and line feed when it reached its 72nd character or when it received a CR/LF from the computer. The computer was also programmed to send the data at 110 baud, the speed needed to talk to a Teletype machine.

Fig. 1 is a diagram of the modifications Louis made to the printer magnet driver board of the Model 33 ASR to allow driving with TTL level, rather than 20-mA current loop levels. It should be noted that transistor Q2 and its associated parts have been removed; modifications to the circuit of Q1 are as shown.

In order to provide a hardware detection of a carriage return, and thus force a hold on data transfer while the type basket returns, the circuit in Fig. 2 can be constructed.

According to Louis, the data signal is taken from the RS-232 port of the Color Computer and is inverted in one section of a hex inverter to make it compatible with the input of the UART. Two clocks using 555s provide the timing signals for the UART. The input clock is made front-panel adjustable to be compatible with the data signal speed coming from the computer. The other clock is set to the Model 33 printer speed of 100 wpm. The serial bit stream output from the UART is inverted in another section of the hex inverter and drives a transistor printer magnet circuit. The parallel data output of the UART receiver section is cross connected to the data input of the UART transmitter section. These same lines are monitored by the carriage return detector circuit. When that command is received from the computer data stream, it causes the 7432 to trigger a 555 pulse generator. This pulse output is inverted by another section of the hex inverter and is used to inhibit the computer from sending any further data until the CR/LF function has been accomplished by the teleprinter.

A short software routine is used by Louis to set up the computer to output at the proper speed, and with the proper delays. The following could either be typed in directly, in the command mode, or placed into a short program:

```
POKE 148,1 : POKE 150,246      'Sets baud rate
                                 to 110
POKE 151,255 : POKE 152,255    'Sets line delay
POKE 153,72                    'Sets
POKE 154,72                    'Printer
POKE 155,72                    'Width
```

Louis' solution is certainly one way to solve the problem, but I am inherently lazy and would like to propose another one. How about a software "filter," which watches the output to the teleprinter and forces a delay in software when a carriage return is sent? A few years back, I wrote such a routine for a Selectric driver, and a similar routine for an ASCII-encoded printer wouldn't be too hard. I might add that, once such a filter is "constructed," some more smarts could be added with little difficulty. I'll put something together and let you all see it next time.

Gene Wagner WA7RCR of Longview, Washington, dropped me a letter with his view of RTTY on the ham bands. He says he started out with the old Model 14s and slowly entered the computer age. Now he has an IBM PC with "all the nice things that go with it, and [he has] about 2,400 RTTY pictures in [his] files that [he exchanges] with other pix nuts around the world."

He questions the availability of programs for the multitude of PC-compatible users, however. It is Gene's impression that those of you who are using any of the "clones" out there are shut out from the bulk of good RTTY programs. Is this so? I have heard very little from PC/PC-clone users, and would look forward to some of your input. Let me hear from you, and I'll be more than happy to open a window to all of your experiences.

I have been thrilled at the number of electronic messages I have received, several of which have ended up in this column. Whether on CompuServe (my ppn is 75036,2501) or on Delphi (user-

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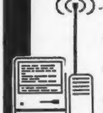

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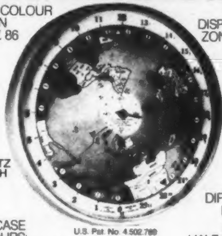

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name is MARCWA3AJR), I am always delighted to receive your electronic comments or questions. I would even venture the statement that, if you did a survey, you would find that the E-mail questions are answered quicker than the posted ones—I think my record E-mail response was while the sender slipped out of the room for a second. Anyway, feel free, as always, to send your comments, questions, or suggestions to me either on-line via the above systems or by way of the plain old Postal Service at the address at the head of this column.

Those of you who may be new to *73*, this being a new year and all, who are reading this column for the first time, may be interested in my periodic offer of reprints from past issues of RTTY Loop. There are about eight editions, which deal with subjects ranging from the basics of RTTY and digital communication to one-chip interfacing circuits. There is a list of available topics, which can be yours for a self-addressed, stamped envelope, sent to the above address.

My next column holds a few predictable items, such as the program hinted at above and a few surprises. Surprises, you say? But of course—otherwise it wouldn't be *73*, and it especially wouldn't be RTTY Loop! ■

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73 INTERNATIONAL

Number 27 on your Feedback card

NOTES FROM FN42

It is increasingly difficult for us to select the material to print here . . . sadly setting aside the rest. Here are some tips to help contributors decide what to send in. In this order, desirable material includes:

1) News items on ham activities in your country which amateurs everywhere will find useful, informative, and/or highly interesting.

2) Reports on licensing requirements and procedures (for visiting hams, but also for residents if special in some way which would be of international interest).

3) Awards and contests that promote inter-nation activities.

4) Human interest stories, historic items, and so on.

For time-critical items, remember: We must receive your information weeks before it can be published! If you want to see something in the April issue, for example, it must reach us by February 1st—by March 1st for the May issue, and so on. Sometimes short items can be dropped into "Roundup" (a new section, see below), even if not received here until 10 or 15 days after the first of a month, but only sometimes!

ROUNDUP

Canada. The Boy Scouts staged an impromptu DXpedition to St. Paul's Island (off Cape Breton) last summer, and a couple of amateurs put CY9SPI on the air. Congratulations from VE1CBF! QSLs to VE1BIZ.

ΟΜΙΛΟΣ ΡΑΔΙΟΕΡΑΣΙΤΕΧΝΩΝ ΚΥΠΡΟΥ
ΤΜΗΜΑ ΛΕΜΕΣΟΥ
CYPRUS AMATEUR RADIO SOCIETY
LIMASSOL GROUP
SPECIAL STATION
C 4 L W F

Three emissaries of Dionysus, L to R, Aris 5B4JE, Andy 5B4IR, and Nicos 5B4CV.

Cyprus. 5B4JE writes that if you wish "to become, together with the local people, protagonists in a feast of human euphoria . . . to banish every care of life . . . to feel innermost comfort and freedom in an atmosphere of unreserved fraternization [and if you wish] to infuse into your being the rays of the sun, the breath of the breeze, the lucidity of the atmosphere . . . ," then come to the Limassol Wine Festival, the first fortnight of every September, and drink some Cypriot wine, with 4,000 years of wine-making experience behind it. Last September you could have attended in spirit (rather than in spirits) with a contact with special-event station C4LWF. For the first 1,000 cards received through the Cyprus Bureau or via 5B4JE, a commemorative QSL diploma will be sent free of charge, together with a special prefix QSL card. (Watch for more info in this column in July or August if the station is activated again.)

Great Britain. "QTQ?" asks G4FAI, aka Tony Smith, one of the three producers of *Morsum Magnificat*, in the Autumn edition of that quarterly publication. It is the first regular English-language edition of the magazine, which has had a Dutch edition for three years. *Morsum Magnificat* "is for all Morse enthusiasts [bringing] together material, which would otherwise be lost to posterity, providing an invaluable source of interest, reference, and record, relating to the traditions and practice of Morse." A year's subscription is available for a US $10 bill sent to Rinus Hellemons PA0BFN, Holleweg 187, 4623 XD Bergen op Zoom, Holland, who also is a publisher. (Dick Kraayveld PA3ALM is the third). If you want to know how come "i" was the shortest complete telegram ever sent, ask that your subscription begin with the Autumn issue. As the maiden English-version issue, it could become a collector's item, also.

AUSTRALIA

J. E. Joyce VK3YJ
44 Wren Street
Altona 3018
Victoria
Australia

FLASH!
THE AULD MUG AWARD

Here in VK6, Australia is defending the right to hold the most coveted trophy in yachting—The America's Cup. In celebration of this important sporting event, the Western Australian Division of the Wireless Institute of Australia is offering an attractive award: The Auld Mug Award!

To qualify for the award, the following conditions must be satisfied:

1) Stations outside Australia (DX) must obtain four (4) points by (a) communication with four licensed amateur stations in VK6 (one point each); (b) communication with the special-event station VK6CUP (four points).

2) VK stations must obtain twelve (12) points by (a) communication with twelve licensed amateur stations in Perth; (b) communication with VK6CUP plus eight Perth stations.

3) All authorized bands and modes are permitted.

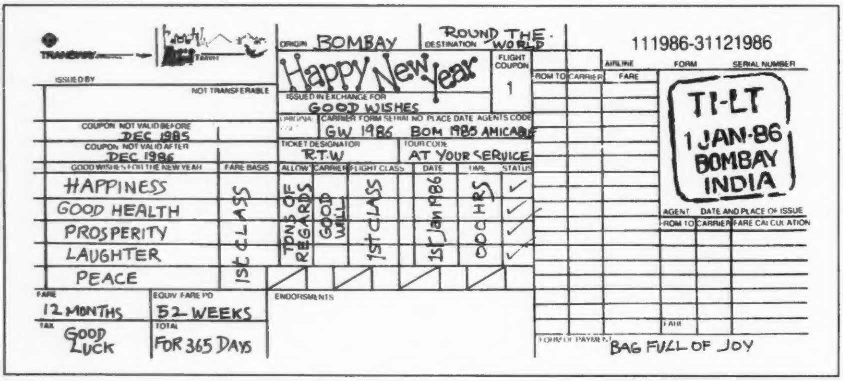
4) All contacts made after October 5, 1986, until the final deciding race in February of 1987 will be eligible.

5) All contacts must be listed showing date, time, band or frequency, and RST report.

6) Shortwave listeners are eligible as per the above rules.

7) QSL cards are not required as proof of valid contacts, but the application must be certified correct.

Applications should be sent to Awards Manager, W.I.A. (VK6 Division), PO Box 10, West Perth 6005, Australia.



ORIGIN BOMBAY
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GOOD WISHES FOR THE NEW YEAR	FARE BASIS	ALLOW	CARRIER	FLIGHT CLASS	DATE	TIME	STATUS
HAPPINESS	1st CLASS	TONS OF REGARDS	GOOD WILL	1st CLASS	1st Jan 1986	000 HRS	✓
GOOD HEALTH							✓
PROSPERITY							✓
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PEACE							

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FORM OF PAYMENT BAG FULL OF JOY

Let this be our New Year's Greetings to you all—just change the dates! This came from (and thank you to) RADIO, *the Journal of the Federation of Amateur Radio Societies of India, for January, 1986. It was a reprint of a card designed by Kamlesh Amin, who is in the travel business.*

Food for thought.

Our new Universal Tone Encoder lends its versatility to all tastes. The menu includes all CTCSS, as well as Burst Tones, Touch Tones, and Test Tones. No counter or test equipment required to set frequency-just dial it in. While traveling, use it on your Amateur transceiver to access tone operated systems, or in your service van to check out your customers' repeaters; also, as a piece of test equipment to modulate your Service Monitor or signal generator. It can even operate off an internal nine volt battery, and is available for one day delivery, backed by our one year warranty.

- All tones in Group A and Group B are included.
- Output level flat to within 1.5db over entire range selected.
- Separate level adjust pots and output connections for each tone Group.
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- Low impedance, low distortion, adjustable sinewave output, 5v peak-to-peak
- Instant start-up.
- Off position for no tone output.
- Reverse polarity protection built-in.

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67.0 XZ	91.5 ZZ	118.8 2B	156.7 5A
71.9 XA	94.8 ZA	123.0 3Z	162.2 5B
74.4 WA	97.4 ZB	127.3 3A	167.9 6Z
77.0 XB	100.0 1Z	131.8 3B	173.8 6A
79.7 SP	103.5 1A	136.5 4Z	179.9 6B
82.5 YZ	107.2 1B	141.3 4A	186.2 7Z
85.4 YA	110.9 2Z	146.2 4B	192.8 7A
88.5 YB	114.8 2A	151.4 5Z	203.5 M1

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2805			1800	2100	2350	

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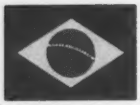


BRAZIL

Gerson Rissin PY1APS
PO Box 12178, Copacabana
20000 Rio de Janeiro, RJ
Brazil

In almost every contest one is used to hearing PY4OD—and sometimes ZW4OD or ZY4OD. Talma Drummond PY4OD is surely one of the best contest operators in the world, SSB and CW. The trophies he has won are the best proof of that.

Talma is a lawyer and 57 years old. In 1956 he got his license, and a CW QSO with OH2YU was his first DX. On that occasion he was very excited and almost unable to copy a single word transmitted by OH2YU. After that very difficult QSO, he never stopped. In the same year he took part in the *CQ* WW Contest on 7 MHz, and his first QSO was with JR6AK in Okinawa. The transmitter was homebrewed, using a 6L6 tube in the final, and the receiver was an Echophone model EC1A.

Trying to improve his rig, Talma changed a few items during his first year. He moved to an 807 tube in the final and a National NC2-40D for a receiver. Talma was not happy yet. Little by little he wired a linear amplifier with two 4-250A tubes excited by an Italian Geloso G-209. . . and serious TVI resulted. Then he bought a Heathkit DX-100 transmitter with a National NC-300 receiver.

It was in the early days of SSB and only a few stations were heard on the bands. There were only four in Brazil, and Talma was one of them. First with a Hasemaster II with a Band Hopper vfo, and finally, in 1960, with the Collins S-Line, KWS-1 and 75A4. The same time, the short three-element yagi gave way to a Telrex Monarch six-element beam. Contests became less difficult for him.

Talma PY4OD.

Talma was the world winner in the following contests: *CQ* WW CW in 1962, 1964, and 1977; *CQ* WW Phone in 1969; *CQ* WW WPX CW in 1979; and ITU Phone/CW in 1978.

As a complete DXer, Talma also has the DXCC Award with 351 countries in the mixed mode, 301 in phone, and 250 in CW. He is an Honor Roll member of the WPX (mixed, CW, and phone) and now is working slowly to the 5BDXCC and 5BWAZ.

Talma says that the best experience he has is while in a contest pileup when an old friend calls him just to wish him good luck. That is his small WORLD!

CHILE

Patricio Fernandez H. CE3GN
PO Box 14781
Santiago
Chile

DXING AGAIN—IN RTTY

All of us know well that amateur radio offers the individual many different fields of activity. As in my case, thousands of hams love DXing and dedicate most of their time to it. A problem arises, however, when one has reached a certain level of countries worked and suddenly the going is getting rough. One is just plain stuck, with practically no hope of working a new one because of poor conditions, or, simply, because after the 300-worked level, it is next to impossible to log more than one or two countries per year at the most.

This happened to me a few years ago, and I was pretty demoralized by the fact that I had lost interest in the hobby; I had lost the joy of continuous DXing. If I were to reach the Honor Roll, at the rate I was going I'd have to wait for at least six or seven years.

After some weeks of thinking about it, I suddenly realized that the solution was simple and easy. Why not start all over again with DXCC, but this time in RTTY?

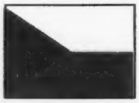
I bought a simple Tono Theta 7000E, and after a few sessions with it felt as comfortable as in SSB—and there I was, again chasing DX as in the good old days. I had forgotten the exquisite happiness of working easy new ones such as CP, LU, CX, etc.—but now in RTTY.

A few months later, I discussed the subject with my good friend and enthusiastic DXer, Enrique CE3BBW, who was experiencing the same frustration I had gone through, and quickly convinced him to get into RTTY. Today we both hold RTTY DXCC. We are always in touch via 2 meters, passing on information about new ones heard that are needed.

In my case, and I am sure Enrique feels the same way, I have regained interest in the hobby, while keeping up with the activity I like the most, DXing. Perhaps this article can inspire a ham who might be just about to dump his rig into the garbage can.

Granted, it is not easy for a DXer whose mother tongue is not English to type in a foreign language, but after some experience one realizes that one can do well with a few, pre-learned sentences. Also, RTTYers are considerably fewer in number than phone DXers, so competition in pileups is less. One finds sportsmanship, fair play, and good manners, too; breakers are practically unknown. All in all, it is a wonderful experience.

By the way, if you need a CE on RTTY, CE3BBW and I are usually fiddling around with the keyboard on 20 meters after 0000 UTC.



CZECHOSLOVAKIA

Rudolf Karaba (OK3KFO ARC)
Gogol'ova 1882
955 01 Topol'cany
Czechoslovakia

Winners. Nearly a year ago OK3LQ succeeded in contacting EI5FK via aurora, for a distance of 1948 km—a new Czechoslovak record by means of this kind of propagation on the 2-meter band, breaking the 1982 OL7BDQ record of 1811 km with GI8YDZ. Radioclub OK2KZR/P made a new Czechoslovak record with station SM7GEP (904 km); OK2BFH also worked this station, but at 902 km.

Every first weekend in July the Czechoslovak amateur radio organization holds a Field Day for Europe. The 1986 contest results are (winner and score, 2nd and 3rd place stations):

- 144 MHz (Input 5 W)—OK3KFF/P 91,591; HG6V/8, OK3KAP/P
- 433 MHz (Input 5 W)—OK3CDR/P 28,789; OK1KEI, OK1KQT/P

Input according to license class:

- 144 MHz—OK1KTL/P 209,866; OK1KRG/P, OK1KIR/P
- 433 MHz—PA0PLY/A 71,428; OK1KIR/P, OK1DIG/P
- 1296 MHz—PA0PLY 29,225; OK1KIR/P, OK1KEI/P
- 2320 MHz—PA0PLY 3,890; OK1KIR/P, OK1KKD/P

The 1985 OKDX Contest results were (winner and score, 2nd and 3rd place stations):

- Single op, all band—LZ2WF 225,180; RB5IM, UA1DZ
- Single op, 1.8 MHz—DL1YD 6,578; UQ2PQ, DL7MAE
- Single op, 3.5 MHz—UP2BOA 11,415; HA6OA, Y27IO
- Single op, 7 MHz—LZ2BE 27,559; HA1XR, OK3LL
- Single op, 14 MHz—OK6DX 35,685; UA4RZ, I2VXJ
- Single op, 21 MHz—UA0SAU 9,177; LZ1NG, UJ8JA
- Single op, 28 MHz—IK2CLB 126; OK3YX, YO6DDF
- Multi-op, all band—UB3IWA 257,796; UP1BWW, OK5W
- SWL—OK1-11861 52,080; OK1-1957, UA6-150767

RTTY. Mirek OK1AWC made these rare contacts on the 14-MHz band recently: TR8DX, WA9PCI/9Q5, TI2PI, OE3HGB/YK, 5N0ALH, PZ1DX, A4XRS (Box 981, Muscat), AM8ORM (Box 162, Santa Cruz de la Palma), 9H1EY/A, and SV5TS (Box 251, Rhodos Island). In the 1985 SARTG RTTY Contest, OK1OAZ (radio club) placed third in the world in the category of collective stations, with 58,000 points for 98 contacts. In SWL, OK1-30342 placed fifth in the world with 7,300 points.

DX. Peter SP7EWL works from Cameroon as TJ1AF and asks that QSLs be sent to his home callsign. Last February, the members of the Soviet polar expedition (sponsored by the magazine *Komsomolskaja Pravda*) were broadcasting as 4K0COC. They were sailing on an iceberg. QSL via UA3AOC.

INDONESIA

Erlangga Suryadarma
YB0BZZ/V85BZ
ORARI National QSL Bureau
PO Box 96
Jakarta 10002
Indonesia

This concludes the overview report on Indonesia, parts 1, 2, and

Uncle Ben says...

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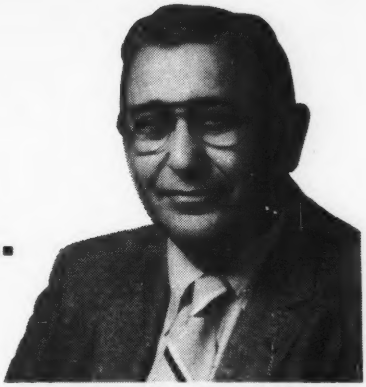

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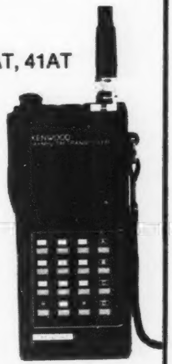
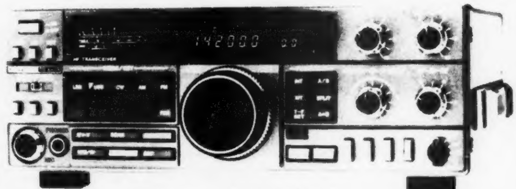


Kenwood TH21AT, 31AT, 41AT



Kenwood TS-440S

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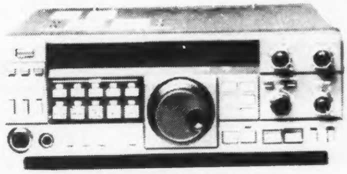

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2	AB–TZ, BAA–TZZ	Central Java
2	UA–YZ, UAA–YZZ	Yogyakarta
3	AB–YZ, BAA–YZZ	East Java
4	AB–EZ, BAA–EZZ	Jambi
4	FA–LZ, FAA–LZZ	South Sumatra
4	MA–RZ, MAA–RZZ	Bengkulu
4	SY–YZ, SYY–YZZ	Lampung
5	AB–MZ, BAA–MZZ	West Sumatra
5	NA–YZ, NAA–YZZ	Riau
6	AB–GZ, BAA–GZZ	Aceh
6	HA–YZ, HAA–GZZ	North Sumatra
7	AB–GZ, BAA–GZZ	West Kalimantan
7	HA–NZ, HAA–NZZ	South Kalimantan
7	OA–TZ, OAA–TZZ	Central Kalimantan
7	UA–YZ, UAA–YZZ	East Kalimantan
8	AB–JZ, BAA–JZZ	South Sulawesi
8	KA–MZ, KAA–MZZ	Southeast Sulawesi
8	NA–PZ, NAA–PZZ	Central Sulawesi
8	QA–UZ, QAA–UZZ	North Sulawesi
8	VA–YZ, VAA–YZZ	Maluku
9	AB–FZ, BAA–FZZ	Bali
9	LA–QZ, LAA–QZZ	West Nusa Tenggara
9	RA–UZ, RAA-UZZ	East Nusa Tenggara
9	VA–YZ, VAA–YZZ	Irian Jaya
0	AB–YZ, BAA–YZZ	Jakarta Raya
1–0	A–Z, AAA–ZZZ	ORARI HQ

Table 1. Indonesian callsign breakdown by province.

3 of which were in the August, September, and November issues of 1986.

Frequency Allocation and Band Plan. The frequency allocation for amateurs in Indonesia was adopted from the WARC Final Act, Geneva, 1979, and imposed under the Directorate General of Post and Telecommunications Regulation No. 39/1981. The 10-MHz band was approved for operation in 1982; the 18-MHz and 24-MHz bands were approved for utilization in 1984 on test basis only, and based on results full operation will be effective starting in 1989. In view of the IARU Region III Association sixth conference, ORARI [Organisasi Amatir Radio Indonesia] has proposed the adoption of the three new bands as follows:

10.100–10.150	CW/RTTY
18.068–18.110	CW
18.100–18.110	RTTY
18.110–18.168	Phone
24.890–24.990	CW
24.920–29.930	RTTY
24.930–24.990	Phone

ORARI Awards Program. (As of 11/85) Available to licensed amateurs the world over, for stations worked or heard: the Jakarta Award (JA/SWL-JA), the Worked All Indonesia Award (WAIA/SWL-WAIA), and the Worked The Equator Award (WTEA/SWL-WTEA). General rules:

"ORARI awards will be issued to licensed amateurs for 2-way SSB, 2-way CW, or 2-way RTTY contact, mixed or single mode, mixed or single band, on 80, 40, 20, 15, and 10 meters only. SWL awards in the same category will also be available. The applicant may request endorsement for such distinction accordingly. To be valid, all contact or listening must have been made on or after July 9, 1968. Claim must be accompanied by a QSL card list (GCR) furnished with the callsigns of stations worked, dates, bands, and modes meeting [award requirements]. QSL card list must be accompanied by a statement from the applicant's national society, club station, or from any two amateurs other than the applicant, that the QSL cards of the contacts listed are in the possession of the applicant, and that the items of the cards are correctly listed. A fee of US $8 or 16 IRCs will be charged per award and should be sent along with the application to the respective awards manager (personal checks not acceptable). Only contact with land stations will be acceptable."

JA. DX stations need contacts with 20 stations, including at least one club station, in the 0 call area. (Indonesia stations need 50 contacts including at least five club stations.) Club stations are: YB0–ZAA, ZAB, ZAD, ZAE, ZAF, ZBA, ZBB, ZCA, ZCB, ZCD, ZCE, ZDB, ZDC, ZDD, ZDE, ZDG, ZEA, ZEE, and ZZ. Awards Manager: Mr. M. S. Lumban Gaol YB0WR, PO Box 96, Jakarta 10002, Indonesia.

WAIA. DX stations need contacts with two stations in each call area (1 to 0, see Table 1) for a total of 20—except *CQ* Zone 28 stations need three each for a total of 30. (Indonesian stations need five from each. QSL card list **must** include YB, YC, and YD stations in each call area.) Awards Manager: Mr. M. Maruto YB0TK, PO Box 96, Jakarta 10002, Indonesia.

אגודת חובבי הרדיו
בישראל
אסיפה שנתית 1986

The Israel Amateur Radio Club honorary president, 4X4AH, opens the 1986 IARC Annual Assembly. L to R: Rami 4Z4LX, Mr. Bar Sela and Mr. Klepner of the Ministry of Communications, Yankele 4X4AH, Evan 4Z4MO, Aharon 4X4AT, and Yosef 4X6KJ (photo by 4Z4MK).

WTEA. Issued for contacts with ARRL DXCC countries along the equator: C2, HC, HC8, HK, KH1 and KB6, PP–PY, PY0 (St. Peter), S9 (Sao Tome), T30, T31, T32, TN, TR, YB5, YB7, YB8, 5X, 5Z, 6O, 8Q, and 9Q. Issued in three classes: I for 15 countries, II for 12, and III for 8; in all classes, contacts with YB5, YB7, and YB8 are obligatory. Awards Manager: Mr. Ben S. Samsu YB0EBS, PO Box 96, Jakarta 10002, Indonesia.

1987 Contest Calendar. *1987 information had not arrived by press time, but two fixed-date contests are ORARI Anniversary, July 6–8, and Indonesia Independence Day, August 17–18.*

ISRAEL

Ron Gang 4Z4MK
Kibbutz Urim
Negev M.P.O. 85530
Israel

Update on Israeli repeaters: All amateurs visiting Israel are invited to use them and get to know the locals. On two meters, all are with input 600 kHz below the printed output frequency, and on UHF the input is 7.6 MHz down. All are straight carrier access—no special tones are required.

Beersheba	145.325
Eilat	145.675
Haifa/Northern Coastal Strip	145.675
(RTTY Mailbox)	145.300
	438.800
Jerusalem	145.625
Safed/Galilee	145.350
Tel-Aviv	145.775
	438.650

You can also hear many QSOs on the simplex channels which are generally to be found from 144.500 up. Being in IARU Region One, we stick to the standard band plan as much as possible, two meters being from 144 to 146 MHz.

Restructuring of callsigns: With the growth of the amateur population, the authorities have decided to make the callsign indicative of the class of license. Novices, who are limited to CW QRP on 40 and 15 meters, will be using calls from the 4Z9AAA–4Z9ZZZ block. Grade B amateurs, with full frequency privileges but limited to

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150 Watts output, will retain their present 4X4, 4Z4, and 4X6 calls with the two-letter suffix. Grade A people, who can run up to 1.5 kW out, will be granted the 4X1 prefix while retaining their old call letters. These new regulations should be in effect by the time you read this, so rejoice, all prefix collectors!

NEW ZEALAND

D. J. (Des) Chapman ZL2VR
459 Kennedy Road
Napier
New Zealand

In April of 1984, the New Zealand Post Office proposed to all ZL amateurs an outline of a new structure for the Amateur Service. The result has been changes in the 1970 Radio Regulations as follows.

There now are only three grades of Amateur Operators Certificates: Novice, Limited, and General, with the first now being permanent instead of annual. The second replaces, unchanged, the old Grade III (non-Morse). The General replaces the old Grades II and I. Entry to the Service may be made at any level; Novice and Limited may be held simultaneously.

Novice privileges: 3.525–3.575 and 28.19–28.60 MHz, 10 W rf output maximum, 30 W PEP. Limited: 51.00 MHz to 400 GHz, all bands, all modes, 120 W output or 400 W PEP. General: for the first 12 months, restricted to 1800–1950 kHz, 3.5–3.9 MHz, and 28.00–29.70 MHz, and all bands above 50.0 MHz; thereafter, all New Zealand amateur bands. Maximum 120 W mean power output or 400 W PEP.

All existing Grade II ops who were restricted for the 12 months listed are now entitled to full privileges, so considerable increase in ZL HF band activities is expected—a thousand or so ZLs are involved.

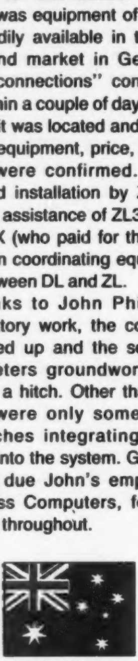
Maintenance of a station log is now at the discretion of the licensee, but ZLs are reminded that there can be occasions when the existence of a log can be a useful safeguard.

PROJECT DL

In August of 1985, three NZART members, Terry Carrell ZL3QL, Ian Ashley ZL1AOX, and John Philpott ZL3THJ, escorted a computer from New Zealand via London to Marburg, Germany, for AMSAT-DL. Although the major costs were met by AMSAT-DL, NZART helped cover the cost of the terminal and incidental expenses. This all came about because Dr. Karl Meinzer DJ4ZC was impressed by the sophistication of much of the equipment he saw in daily shack use when he was here for the NZART Conference.

At ZL2JW's he noticed a DEC-Digital LST-11/23 minicomputer and discovered that it was what he needed for fast number crunching—it was equipment of a class not readily available in the second-hand market in Germany. Ham "connections" connected, and within a couple of days a suitable unit was located and the details of equipment, price, and delivery were confirmed. These included installation by ZL3THJ and the assistance of ZL3QL and ZL1AOX (who paid for their own travel) in coordinating equipment use between DL and ZL.

Thanks to John Philpott's preparatory work, the computer was fired up and the software/parameters groundwork done without a hitch. Other than that, there were only some initial headaches integrating Karl's printer into the system. Gratitude also is due John's employers, Business Computers, for their support throughout.



NORFOLK ISLAND

Kirsti Jenkins-Smith VK9NL
PO Box 90
Norfolk Island, 2899
Australia

HONOR TO VK

Norfolk Island was honored to have one of its five operators elected to the *CQ* DX Hall of Fame this year. Jim Smith VK9NS is the first VK ever to have achieved this recognition.

QSLing AND FINANCIAL RUIN

Operating from a place like Norfolk Island automatically throws the new operator onto the DX scene. VK9 *IS* DX, attracting hundreds of callers who need the Island for a new country. If they are chasing DXCC, they will want confirmation of the contact. Operators of the DX stations face financial ruin if they try to meet the expense of cards, envelopes, and postage to all of these callers.

The serious DXer is aware of the problems and includes return postage and a self-addressed envelope with his QSL. Others QSL via the bureau. Bureau cards soon amount to thousands, exceeding both time and money available for "free" QSLing. In addition, Norfolk Islanders cannot just hop on the plane and travel 900 miles to the mainland to pick up their bureau cards. They, therefore, are obliged to pay postage—for cards received as well as for outgoing cards—to the VK division handling VK9 cards. VK9 is composed of Norfolk Island, Lord Howe Island, Willis Island and Mellish Reef (uninhabited), Cocos Keeling, and Christmas Islands.

There is no such thing as a VK9 bureau. The islands do *not* form a cozy little group where we can jump into our canoes and paddle through balmy waters to a central QSL bureau! The surest way to get a QSL card is by direct QSLing, including SAE and postage. If you have heard warnings about DX stations pocketing postage money and not QSLing, well there are such people in the world, but would such a person be likely to QSL through a bureau in any case?

GOOD NEWS

Our AM broadcasting station is operating again. The transmitter went to the U.S. for repairs, but when it arrived back it was found to have been damaged in transit. It then had to go to the mainland for further repair. Anyway, it may now be heard on 1566 kHz (VL2NI) from 1930 UTC through 1130 UTC the following day. (That's 0700–2300 local time.)

And the VK9NS/VK9NL shack is rarin' to go after repairs. A cow chewed and swallowed one of the phasing lines on the 40m array in the paddock, the tribander received storm damage, and the whole length of coax from beam to shack had to be replaced—apparently those nice birds we like listening to in the mornings liked to peck holes in it. VK9NS is working 160 and 80 almost daily from about 0630 UTC (our sunset) and about 1000 UTC, following the sunrise across the U.S. The hours will, of course, change with the seasons, but anyone with a DX edge can work out our sunset and his own sunrise.

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THE NEW ELECTRONIC COMMUNICATIONS PRIVACY ACT

The hotly debated Electronic Communications Privacy Act of 1985 became an act of 1986 before it finally became law. In early October of 1986, the ECPA passed both houses of Congress. The radio protection provisions of the new law will go into effect in mid-January, 1987, about the time you read this column. The final draft of the bill was printed in the October 1, 1986, issue of the *Congressional Record*, starting on page S-14441.

Throughout the proceedings, a number of personal radio groups were active in fighting against the most restrictive aspects of the bill. At one point, provisions were about to be included that would have forced the communications privacy statutes to cover even ham radio phonepatch and autopatch. There was also a fairly well-founded rumor that certain business interests, eyeing the amateur VHF and UHF spectrum, were attempting to get provisions added that would ban any "ciphered" amateur communications.

What was meant by ciphered communications? That's hard to say. Many think that it would have meant an end to packet, AMTOR, and possibly even CW! But we can forget all of this. For the most part radio amateurs fared pretty well with regard to their own service, but with regard to other communications hams now fall into the category of the general public.

And, it is really the general public that the radio communications aspects of the ECPA can hurt the most. The radio hobbyist who wants to listen to everything coming into his home is no longer free to do so. In fact, John Q. Public does not know it yet, but if he turns a radio to the wrong frequency—even by accident—he technically becomes a criminal. It's doubtful that he will ever pay a fine or go to jail, but that threat now looms over everyone's head.

One of the best-versed people on the subject of the ECPA is Robert Horvitz, the Washington DC based government affairs liaison officer for the Association of North American Radio Clubs. Robert is with ANARC's political arm, representing the interests of SWLs and other radio-monitoring hobbyists. He is also a very intuitive individual and an excellent analyst of matters such as these. What follows is his "preliminary analysis of the Electronic Communications Privacy Act of 1986." Read it carefully, as it affects you.

The New Law

The ECPA amends the U.S. code title 18, chapter 119, the federal law governing the interception of "wire" and "oral" communications, to protect a new legal category of "electronic communication." It sets new rules for electronic surveillance by law enforcement agencies, and for investigative access to electronic mail and computer files. It also increases criminal penalties for malicious interference with satellite transmissions.

> ***"Taken literally, the new law makes listening to FM stereo broadcasts and the audio portion of television broadcasts a federal crime."***

Electronic communication is defined as "signs, signals, writing, images, sounds, data, or intelligence of any nature transmitted in whole or in part by a wire, radio, electromagnetic, photoelectronic, or photo-optical system that affects interstate or foreign commerce, but does not include a) the radio portion of a cordless telephone communication, b) any wire or oral communication, c) any communication made through a tone-only paging device, or d) any communication from a tracking device."

Radio and wire transmissions are thus merged in this new term. However, the new law also retains and adapts the earlier legal definition of wire communication as a category separate from electronic communication. Wire communication now means voice telephony, regardless of whether the transmission is by wire, radio, or other electronic means. In other words, non-voice communications by wire are considered "electronic" communications, as are communications by radio that do not involve telephone transmission.

Unauthorized interception of the radio portion of a wire or electronic communication carries lesser penalties than does interception of the wire segment of the same communication—if it's not for an illegal, commercial, or tortious purpose. See the "Penalties" section below for details.

What May Be Legally Monitored

1) Any marine or aeronautical radio communication.

2) Any amateur, CB, or general mobile radio service transmission.

3) Any communication transmitted "for the use of the general public, or that relates to ships, aircraft, vehicles, or persons in distress."

4) The radio portion of cordless telephone communications linking the handset and the base unit.

5) Tone-only paging signals.

6) Certain types of audio subcarriers (to be specified in a Senate report).

7) Signals causing harmful interference to "any lawfully operating station or consumer electronic equipment to the extent necessary to identify the source of the interference."

8) Satellite transmissions of "network feeds," some satellite audio subcarriers, and cable-destined programming covered by section 705Z(b) of the Communications Act.

9) Any governmental, law enforcement, civil defense, private land mobile, or public safety (including police and fire) radio communications system that is "readily accessible to the general public."

10) Any other electronic communication made through a system "configured so that such electronic communication is readily accessible to the general public."

In most cases, radio communications defined as not "readily accessible" will be legal to monitor, unless one of the foregoing exemptions applies. "Readily accessible to the general public" is defined to mean that the communication is not:

1) Scrambled or encrypted.

2) "Transmitted using modulation techniques whose essential parameters have been withheld from the public with the intention of preserving the privacy of such communication." (The House report says that this means and includes spread-spectrum signals.)

3) "Carried on a subcarrier or other signal subsidiary to a radio transmission."

4) "Transmitted over a communication system provided by a common carrier" (except for tone-only paging signals).

5) Transmitted on frequencies allocated under FCC rules Part 25 (communication-relay satellites), Part 74(d) (remote broadcast pickup stations), Part 74(e) (aural broadcast auxiliaries, including studio-to-transmitter links), Part 74(f) (television broadcast auxiliaries and studio-to-transmitter links), or Part 94 (private fixed microwave).

As mentioned above, there are some exceptions to the general ban of allegedly "inaccessible" signals. For example, the radio emission of a cordless phone may be monitored, even though it relays common carrier communications. Similarly, marine and aeronautical radiotelephone signals are legal to monitor. (In contrast, phone patches in the 800-MHz specialized mobile radio service are legally protected, since the phrase "readily accessible" qualifies the exception for private land mobile radio, which includes SMRs.)

The forthcoming Senate report on the ECPA is expected to identify the types of audio subcarriers that may legally be monitored, even though the new law declares that all subcarriers are inaccessible. (Taken literally, that makes listening to FM stereo broadcasts and the audio portion of television broadcasts a federal crime.)

Although broadcast remote pickup (RPU) stations authorized under FCC Part 74(d) are declared to be "inaccessible," they operate near 26, 153, 161, 166, 170, 450, and 455 MHz, usually with citywide audio coverage.

Used by broadcasters to coordinate the coverage of events outside the studio, RPUs can be received on most scanners. They are a favorite among scanner owners because of their newsgathering role. As the result of an amendment to the ECPA introduced by Senator Paul Simon at ANARC's request, the ECPA creates no criminal liability for monitoring RPUs when monitoring is for no bad purpose. (The following section supplies information about civil liabilities.)

Penalties

For most unencrypted radio communications protected under the ECPA, intentional unauthorized interception carries a criminal penalty of up to one year in jail and/or a fine of up to $100,000 for a first offense that is not for a bad purpose—i.e., "not for a tortious or illegal purpose or for purposes of direct or indirect commercial advantage or private commercial gain."

If it is a "private land mobile radio service" communication (i.e., a cellular or a traditional IMTS radiotelephone call) or any type of paging except for tone-only, and if the signal is not scrambled or encrypted, and if the interception is intentional but not for a bad purpose, the penalty for a first offense is a fine of up to $500.

If the communication is scrambled or encrypted or if the interception is for bad purposes or is a second or subsequent offense, the penalty is up to five years in jail and/or a fine of up to $100,000.

Intentional interception of an unencrypted Part 74(d) transmission, without bad intent, carries no criminal penalties. However, the federal government may seek a court injunction against a specific interceptor and assess civil damages of up to $500. Any violation of the injunction carries with it a mandatory $500 civil fine, liability for any actual damage suffered by the plaintiff, or statutory damages of up to $1,000.

Any criminal violation of the ECPA exposes the interceptor to civil liabilities (risk of a lawsuit). For any violation other than those described in the last paragraph, courts may reclaim any profits made from or damages caused by the interception, or assess statutory damages of $100 for each day of violation, or impose a fine of $10,000, whatever is greatest.

Intentional Versus Inadvertent

The ECPA makes it a federal crime to intentionally intercept, disclose, or use electronic communications protected under this act. Even "endeavors to intercept" are a crime [section 2511(1)(a)]—even if you do not succeed! Under the ECPA, acting on the intention is sufficient to constitute a crime.

Obviously, the exact legal meaning of "intentional" and the kind of proof required to establish intent in court are crucial. The House report says that intentional means that acquiring the contents of an electronic communication is one's "conscious objective." According to this House report, requiring intent "precludes the application of civil or criminal liability for acts of inadvertent interception."

However, the report adds: "The term 'intentional' does not require that the act was committed for a particular purpose or motive." The ECPA thus does not criminate the act so much as the "state of mind" or attitude relating to the act. Interception achieved by accident is not a crime.

> ***"It's ironic that the thanks for our salvation must go primarily to a non-ham group."***

Unfortunately, this distinction is rather murky in the case of recreational scanning with a multi-band radio receiver. Does casual browsing constitute intentional or inadvertent interception? What about automatic band-searching? And, what constitutes proof of intent—the possession of a frequency list? We hope for answers in the upcoming Senate report. In any event, requiring proof of intent should limit a hobbyist's chances of being successfully prosecuted for recreational monitoring that causes no detectable harm to those whose radio communications were tuned in.

Surreptitious Interception Devices

An easy way to enforce the ECPA would be to criminate ownership of devices capable of receiving protected communications. In fact, the ECPA amends sections 2512 and 2513 of the U.S. code title 18 in an attempt to do just that. When the new law goes into effect, it will become illegal to manufacture, assemble, possess, sell, advertise, or send through the mail any electronic device whose design "renders it primarily useful for the purpose of surreptitious interception of wire, oral, or electronic communications."

Due to imprecise drafting, the ECPA's ban on "surreptitious interception devices" does not distinguish between electronic communications that are legal to receive and those that are illegal. Depending on how the word "surreptitious" is defined, an AM-FM broadcast receiver concealed in a stuffed animal could qualify as an illegal device; similarly, a microcomputer with a modem and built-in code-breaking software might also constitute an illegal device, depending on how the word "primarily" is defined. We can only hope that the Senate report defines surreptitious interception devices in a way that is both clear and narrow. We also hope for insight into the legal status of subcarrier tuners, voice inverters (simple descramblers), teletext readers, radioteletype terminals with bit-code translation features, and programmable scanners.

A Final Look

I think that what Robert Horvitz has written requires little explanation by me. Therefore, I will not dwell on the effect that the ECPA has on the general public. But as radio amateurs concerned with the very narrow realm of our own Part 97, U.S. amateur service, we are totally unscathed by the ECPA.

The forces that hoped to "quietly" clobber radio amateurs through this new law not only backed away because of all of the negative publicity that our ranks generated, but now deny that they ever intended us any harm. To them I have only these few words: "You declared yourselves to be our enemies when you started this farce, and there is no reason to think that corporate 'leopards' will ever change their spots."

They envy what we have, and when it comes to spectrum, what we have is worth hundreds of billions of dollars in corporate profits if reallocated to potentially paying users. I suspect that, given the chance, they would pounce on us and damage or destroy our service's viability so as to eventually gain access to the very lucrative spectrum we now possess.

It's ironic that the thanks for our salvation must go primarily to a non-ham group. It was an SWL organization called the Association of North American Radio Clubs that readied up the very best opposition of all. It was the only radio hobbyist group that had full-time personnel in Washington DC following the ECPA from the day of its inception until it cleared Congress. It was the one group that really made a difference. Of special note is the work on this matter done by ANARC's outgoing executive secretary Richard T. "Terry" Colgan WD5GWC. Terry and his crew lead a valiant battle to preserve the rights of all radio hobbyists—ham and non-ham alike. While other organizations such as the Scanner Association of North America, several CB groups, almost all of the Ham Radio Press, and finally even the ARRL provided some measure of support, in reality it was ANARC that stood at the head of the pack. To that end, ANARC, we salute you.

ECPA Postscript: Help Wanted

The following appeared in the want-ads employment section of the *Washington Post* shortly after the Electronic Communications Privacy Act of 1986 was signed into law:

"PUBLIC RELATIONS MANAGER FOR TELECOMMUNICATIONS ASSOCIATION.

A leading national trade association headquartered in Washington DC is seeking an experienced Public Relations Manager. The person will be responsible for generating media coverage of the Mobile Communications industry; providing comprehensive information to members as well as the general public, and promoting the association and its position to the membership and the industry at large. Respond to Box M-6723, *Washington Post*, 1150 15th Street NW, Washington DC 20071."

Question: Could this be some early fallout from the inability of at least one of the communications lobbyists to get what his employer wanted included in the ECPA?■

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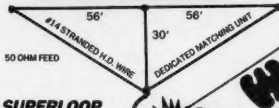

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AMATEUR- HIGHEST EFFICIENCY- 200 WATTS TO 10,000 WATTS- FIVE YEAR GUARANTY- QUALITY-

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50th Anniversary

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We don't just advertise it — WE GIVE IT!

In 1937, Stan Burghardt(W0IT), because of his intense interest in amateur radio, began selling and servicing amateur radio equipment in conjunction with his radio parts business. We stand proud of this long-lasting tradition of *Honest Dealing, Quality Products, and Dependable "S-E-R-V-I-C-E"!*

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Yaesu FT-727R
DUAL BAND TRANSCEIVER
140-150 MHZ / 440-450 MHZ

CALL FOR PRICE

The FT-727R is a completely self-contained VHF and UHF FM hand portable transceiver providing up to 5W or 0.5W RF output on user-selectable channel steps across both the 2m and 70cm (FM) amateur bands. Twenty dual-function keys on the front panel give the operator 40 different commands for programming the CMOS microprocessor at the heart of the FT-727R, markedly simplified and improved over previous models. Ten standard memories are provided, four of which allow storage of independent transmit and receive frequencies, for odd repeater splits or cross band operation with touch-key reverse. An independent "dial" memory and call channel memory are provided for each band. User settable repeater shifts can be activated on the dial or recalled memories. Also features *Power Saver System* (now with digital display timer), which only activates the receiver to check the selected channel momentarily at programmable intervals.

DAYTON Hamvention

April 24, 25, 26, 1987

Early Reservation Information

- **Giant 3 day flea market • Exhibits**
- **License exams • Free bus service**
- **CW proficiency test • Door prizes**

Flea market tickets and grand banquet tickets are limited. Place your reservations early, please.

Flea Market Tickets

A maximum of 3 spaces per person (non-transferable). Tickets (for all 3 days) will be sold IN ADVANCE ONLY. No spaces sold at gate. Vendors MUST order registration ticket when ordering flea market spaces.

Special Awards

Nominations are requested for 'Radio Amateur of the Year', 'Special Achievement' and 'Technical Achievement' awards. Contact; Awards chairman, Box 44, Dayton, OH 45401.

License Exams

Novice thru Extra exams scheduled Saturday and Sunday by appointment only. Send current FCC form 610, copy of present license and check for $4.25 (payable to ARRL/VEC) to: Mark Tessneer, 2859 Homeway Dr., Beavercreek, OH 45385

Slide Show

35 mm slide/tape presentation about the HAMVENTION is available for loan. Contact Dick Miller, 2853 La Cresta, Beavercreek, OH 45324

1987 Deadlines

Award Nominations: April 4
Lodging: April 4
License Exams: April 4
Advance Registration and banquet:
USA - April 11
Canada - April 4
Flea Market Space:
Orders will not be accepted **before** January 1

Information

General Information: (513) 433-7720
or DARA, Box 44, Dayton, OH 45401
Flea Market Information: (513) 223-0923
Lodging Information: (513) 223-2612
(No Reservations By Phone)

HAMVENTION is sponsored by the Dayton Amateur Radio Association Inc.

Lodging Reservation Form

Dayton Hamvention - April 24, 25, 26 1987
Reservation Deadline - April 4, 1987
MAIL TO - Housing, Dayton Hamvention,
1980 Kettering Tower, Dayton, OH 45423-4880

Arrival Date ________________
☐ Before 6 pm ☐ After 6 pm
Departure Date ________________
Room: ☐ Single
☐ Double (1 bed, 2 persons)
☐ Double Double (2 beds, 2 persons)

Lodging Preference -
See list of Lodging on adjacent page.

1 ________________ 2 ________________
3 ________________ 4 ________________

Deposit required - Room deposit must be paid directly to the hotel or motel by date shown on the confirmation form sent to you. Use canceled check for confirmation.

Advance Registration Form

	How Many		
Admission (valid all 3 days)	______	@ $8.00*	$______
Grand Banquet	______	@ $15.00**	$______
Women's Luncheon			
(Saturday)	______	@ $7.25	$______
(Sunday)	______	@ $7.25	$______
Flea Market (Max. 3 spaces) *Admission ticket must be ordered with flea market tickets*	______	@ $23.00	$______
		Total	$______

Make checks payable to - Dayton HAMVENTION.
Mail to - Dayton Hamvention, Box 2205, Dayton, OH 45401

* $10.00 at door ** $17.00 at door, if available

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—J. Trenbick

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—Fred Blechman, K6UGT

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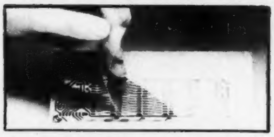

WITH TEC-200 FILM

JUST 3 EASY STEPS:
- Copy circuit pattern on TEC-200 film using any plain paper copier
- Iron film on to copper clad board
- Peel off film and etch

convenient 8½ × 11 size
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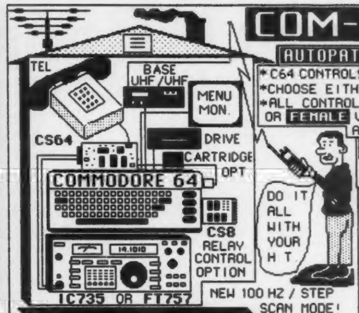
COM-SHACK 64 SIMPLEX OR DUPLEX SHACK CONTROL



NEW 100 HZ / STEP SCAN MODE!

AUTOPATCH * H.F. REMOTE * REPEATER CONTROL
*C64 CONTROLS YOUR FT757 IC735 TS440/940 WITH YOUR H T
*CHOOSE EITHER SIMPLEX OR FULL DUPLEX CONTROL MODES!
*ALL CONTROL FUNCTIONS ARE ACKNOWLEDGED WITH A CLEAR MALE OR FEMALE VOICE! * VOICE CLOCK SET TIME FROM YOUR H T
ALL USER PARAMETERS SAVED FOR FAST START-UP!

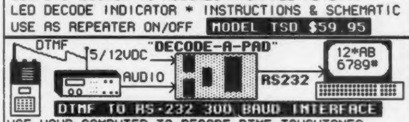
AUTOPATCH TONE OR PULSE, CALL WAITING, ANSWER SECOND INCOMING CALL, LAST NUMBER MEMORY, VOICEPAGE ON INCOMING CALL * AUTODIAL * REDIAL

H.F. REMOTE 9 MEMORY FREQUENCIES. SCAN UP, DOWN, FAST, SLOW * ENTER OR RECALL ANY FREQ FROM MEMORY * CHANGE MODES USB/LSB/FM/AM CONTROL 8 RELAYS (CS8 OPTION) ON/OFF WITH VOICE CONFIRMATION * NEW 100 HZ SINGLE STEP TUNE MODE!

SIMPLEX MODE (1 VHF OR UHF TRANSCEIVER) MENU SETS UP ALL TIMING WINDOWS. TIME BETWEEN WINDOWS, TIMERS, ACCESS CODES, CALL SIGN * LISTENS FOR CLEAR FREQ BEFORE TRANSMITTING

NO FILTERS!
NO FALSING!
TOUCHTONE DECODER KIT
DTMF RECEIVER KIT
*SSI 201 DTMF RECEIVER KIT
*RECEIVE ALL 16 DTMF DIGITS
*NO ADDITIONAL FILTERING
*OUTPUT BCD OR HEX FORMAT
*LOW POWER DRAIN(29MA/12V)
KIT INCLUDES 3.58 MHZ XTAL 22 PIN IC SOCKET, RESISTOR, CAPACITORS, DATA SHEET SCHEMATICS; EASY TO BUILD MODEL TTK $ 22.95

4 DIGIT SEQUENCE DECODER (ON/OFF)
2" 3.5"
*WIRED AND TESTED, 5 TO 12V.
*USER PROGRAMABLE 50,000 COMBINATIONS ANY 16 DTMF TONES*SEND CODE ONCE TO TURN ON; AGAIN TO TURN OFF* MOMENTARY AND LATCHING OPEN COLLECTOR TRANSISTOR OUTPUTS*CUSTOM IC ASSURES HIGH RELIABILITY LED DECODE INDICATOR * INSTRUCTIONS & SCHEMATIC USE AS REPEATER ON/OFF MODEL TSD $59.95



DTMF TO RS-232 300 BAUD INTERFACE
USE YOUR COMPUTER TO DECODE DTMF TOUCHTONES * RECEIVE ALL 16 DIGITS AS FAST AS THEY CAN BE TRANSMITTED * EASILY PROGRAM YOUR COMPUTER IN BASIC TO DECODE MULTIDIGIT "STRINGS", DISPLAY DIGITS, SOUND ALARMS, OBSERVE SECRET CODES * SIMPLE TO INSTALL; HOOK 12 VDC, AUDIO & TWO WIRES TO YOUR COMPUTER -- ENTER A SIMPLE BASIC PROGRAM (PROVIDED) AND BEGIN TO DECODE * INCLUDES DATA LED; WIRED AND TESTED-- MODEL DAP $ 89.95

ICOM IC-02AT USER'S "AUDIO BLASTER"
MODULE INSTALLS INSIDE THE RADIO IN 10 MIN. BOOST AUDIO TO NEARLY ONE WATT! * LOW POWER DRAIN(4MA STAND-BY) * COMPLETE INSTALLATION INSTRUCTIONS INCLUDED * CORRECTS THE LOW AUDIO PROBLEM * 1000'S OF SATISFIED CUSTOMERS! FOR IC02AT/IC04AT/IC2AT
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REPEATER * H.F. REMOTE * AUTOPATCH
ALL ABOVE FEATURES PLUS REPEATER CONTROLLER, WITH, HANG TIME, COURTESY BEEP, REPEATER ON/OFF ACCESS CODES, AUTOMATIC VOICE ID, ALL TIMERS SET FROM START-UP MENU * YAESU 2700 VHF/UHF MAKES INSTANT CROSSBAND REPEATER. NO DUPLEXER REQUIRED DUPLEX OR SIMPLEX CONTROL
MODEL CS64 $249.95 PLUS 3.00 S/H USA & CANADA
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TURNS UP TO EIGHT DEVICES ON AND OFF WITH VOICE CONFIRMATION WHEN IN THE H F REMOTE MODE * 3 DPDT 2 AMP RELAYS INCLUDED & 5 MORE OPEN COLLECTOR 100MA OUTPUTS * PLUGS INTO JOYSTICK PORT * INC 24 PIN CONN
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14.280MHZ N16R

( )MODEL( ) $________
( )MODEL( ) $________ TOTAL$________
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CITY STATE ZIP
MC/VISA # EXP

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Days Inn South
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Hampton Inn (Englewood)
Holiday Inn Wright State
Holiday Inn Dayton Mall
Holiday Inn Fairborn
Holiday Inn North
Holiday Inn South
Holiday Inn Troy
Knights Inn Franklin
Knights Inn Dayton North
Knights Inn Dayton South
Knights Inn Vandalia
L & K Motel (Brandt Pike)
LaQuinta Inn South
Marriott Hotel
Motel Capri
Penny Pincher (L&K Troy)
Ramada Inn Downtown
Ramada Inn South
Red Horse Inn
Red Roof Inn South
Rodeway Inn (Dayton)
Rodeway Inn (Xenia)
South Dayton Motel
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Your company name and message can contain up to 25 words for as little as $150 yearly (prepaid), or $15 per month (prepaid quarterly). No mention of mail-order business or area code permitted. Directory text and payment must reach us 60 days in advance of publication. For example, advertising for the April '87 issue must be in our hands by February 1st. Mail to *73 Amateur Radio*, WGE Center, Peterborough, NH 03458. ATTN: Hope Currier.

PROPAGATION

Number 23 on your Feedback card

Jim Gray W1XU
73 Staff

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA							20	20				
ARGENTINA	20	40	40	40	80	80				20	15	15
AUSTRALIA	20		20		40	40	20	20			15^1	15^1
CANAL ZONE	15	20	20	40	40		20	20	15	15	15*	15*
ENGLAND	20	40	80	40	40		20	20	20	20	20	20
HAWAII	20		20		40	40	80	20			15^1	15^1
INDIA	20-40^1					20^1	40^1	20^1				15^1
JAPAN	20						20	20				20
MEXICO	15	20	20	40	40		20	20	15	15	15*	15*
PHILIPPINES							20					
PUERTO RICO	15	20	20	40	40		20	20	15	15	15*	15*
SOUTH AFRICA			40^1	40^1				15	15	15	20	20
U. S. S. R.	40	80	80	40			20	20	20			40
WEST COAST		80	80	40	40	40	20	20	20			

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA						80*	40*	20				
ARGENTINA	20		40	40	40						15	15
AUSTRALIA	15					40	20	20	20			15
CANAL ZONE	20	80	40	40	40	40	20	20	15	15	15	20
ENGLAND	40	40	40	80				20	15	20		40
HAWAII	15	20			40	40	40				15	15
INDIA	15^1	20^1	20^1				40^1	20^1	20^1			
JAPAN						80*	40*	20				
MEXICO	20	80	40	40	40	40	20	20	15	15	15	20
PHILIPPINES								20				
PUERTO RICO	20	80	40	40	40	40	20	20	15	15	15	20
SOUTH AFRICA	20	40*							15	15	20	20
U. S. S. R.	40		40	40				20	20			

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15	20			40	40	40	40	40			20
ARGENTINA	15	20		40	40	40	40	40		15	15	15
AUSTRALIA	15	20	20				40	80*	40	15	15	15
CANAL ZONE	20	20		40	40	40			20	15	15	15
ENGLAND			80*	40					20	20		
HAWAII	15	15			20	20	20	20				15
INDIA		20										
JAPAN	15	20			40	40	40	40	40			20
MEXICO	20	20		40	40	40			20	15	15	15
PHILIPPINES	15	20					40	40		20		20
PUERTO RICO	20	20		40	40	40			20	15	15	15
SOUTH AFRICA	20	40^1	40^1							15	15	20
U. S. S. R.		40^1	40^1	40^1	40^1				20	20		
EAST COAST		80	80	40	40	40	20	20	20			

1 = May be open only once or twice during month.
*** = Try next higher band.**

G = Good, F = Fair, P = Poor.

JANUARY

SUN	MON	TUE	WED	THU	FRI	SAT
				1 F–P	2 P	3 P–F
4 F–G	5 G	6 G–F	7 P	8 P	9 P–F	10 F
11 F	12 F–G	13 G	14 G	15 G	16 G–F	17 F
18 F–P	19 P	20 P	21 P–F	22 F	23 F–G	24 G
25 G–F	26 F	27 F	28 F–P	29 P	30 P–F	31 F–G

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5 1 4 DISK FILE 10-3PK	$8.42
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3.5 DISK FILE 30 XL	$10.37
DISK CLEAN KITS	$11.67 $10.37

KALMAR

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TEAK ROLL TOP #453 3.5 (90)	$24.67
TEAK ROLL TOP #454 5.25 (50)	$21.42
TEAK ROLL TOP #455 5.25 (100)	$31.95
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4144 3 UP2 1 2×15 16 (3000)	$9.17
4143 2 UP 4×15 16 (3000)	$8.52
4145 3 1 2×15 16 (1000)	$4.74
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4169 3×5 INDEX CARD (500)	$7.46
4168 2 1 16×4 INDEX CD (500)	$6.47
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CT 100 P A-B SWITCH BOX	$51.96
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PRINT STANDS

CURTIS PS 1	$14.95
ALLSOP PS 1	$12.97

SYSTEM STANDS

CURTIS SS 3 SYSTEM STAND	$19.47
THOMSON 1214 SWIVEL BASE	$19.50

BOARD PRODUCTS

VIDEO 7

VEGA EGA	$389.35
MONOGRAPHIC MGA	$162.47
MONOGRAPHIC PLUS	$194.97

MAXELL

MD 1	$11.75
MD 2	$14.95
MF 1DD	$24.70
MF 2DD	$29.95

BASF

FLEXI 1D 5PK	$11.95
1 D 5.25 SS/DD	$11.25
2D 5.25 DS/DD	$25.98
2HD 5.25 DS/DD	$34.95

OPUS

5.25 DS/DD	10 PK	$6.88

ANCHOR AUTOMATION

SIGNAL MODEMS

SM 1 LIGHTNING 24	$389.35
SM II EXPRESS	$289.35
SM 3 ERROR FREE	$129.35
SM 5 SECURE 12	$324.35

ANCHOR

VM 2 VOLKSMINI	$129.35
VM 6420 VOLKS 6420	$129.35
VM 6470 VOLKS 6470	$129.35
VM 12 VOLKSMODEM 12	$194.35
VM 1 VOLKSMODEM	$51.96
F & J CABLE	$25.97
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SP 1 DIAMOND PLUS	$40.26
SP-2 EMERALD	$45.46
SP-3 SAFE STRIP	$19.95
SPF-1 SAPPHIRE	$51.97
SPF-2 RUBY	$58.47
SPF-2+ RUBY PLUS	$71.46
SP 1 DIAMOND	$37.46

MONITORS

THOMSON

CM 31311 HI RES 12" RGB	$408.85
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CM 36382 14" RGB	$356.85
CM 31481 12" RGB COMPOSITE	$291.85
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VM 3107IG 12" GREEN MONOCHROME	$129.35
VM 3102IA 12" AMBER MONOCHROME	$109.85
VM 3102VG 12" HI RES GREEN COMPOSITE	$103.35
VM 3102VA 12" HI RES AMBER COMPOSITE	$109.85
VM 3101VG 12" GREEN COMPOSITE	$83.85
VM 3101VA 12" AMBER COMPOSITE	$87.10
CM 36311ID 14" COLOR EGA	$516.95

BROTHER

HR 20 LETTER QUALITY	$374.25
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M1509 DOT MATRIX	$399.00
HR 35 LETTER QUALITY	$681.85
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TWINWRITER 5	$841.75
HR 10 LETTER QUALITY	$249.00
M1109 DOT MATRIX	$224.25
CF 100 CUT SHEET FEEDER	$194.35
CF 300 CUT SHEET FEEDER	$211.25
CF 150 CUT SHEET FEEDER	$194.35
TF 150 TRACTOR FEED	$109.85
TF 100 TRACTOR FEED	$109.85
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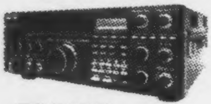

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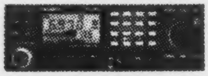

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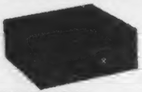

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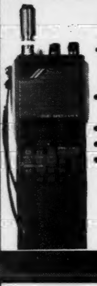

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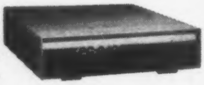

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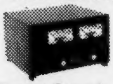

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- **CTCSS encoder built-in.** TSU-4 CTCSS **decoder** optional.
- **10 memory channels store any offset.** Each memory channel can store frequency, frequency step, offset, **reverse switch position,** and CTCSS frequency.
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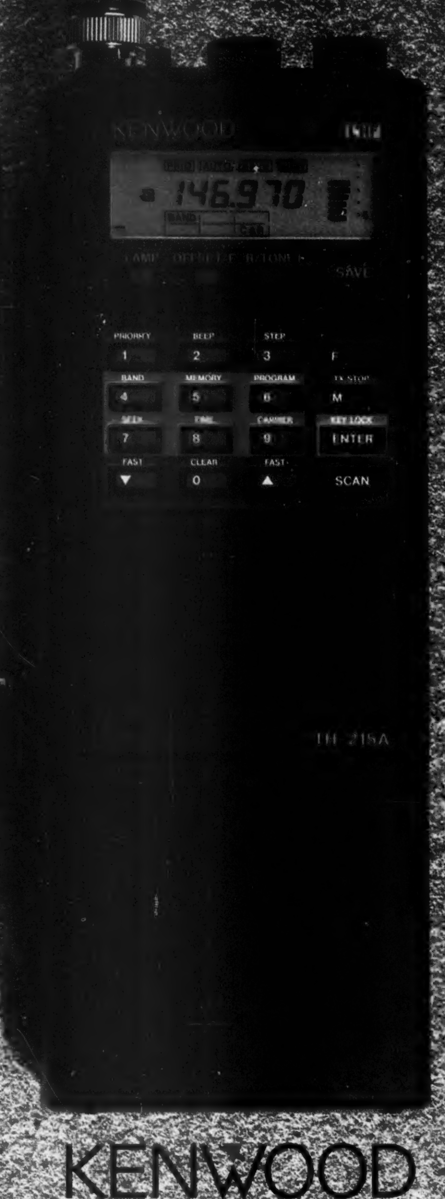

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Complete service manuals are available for all Trio-Kenwood transceivers and most accessories. Specifications and prices are subject to change without notice or obligation.